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JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania;

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

EDITED

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JANUARY, 1835.

*Report to the Board of Directors of the London and Birmingham Railway, on the Formation of a Railway by Undulatory Planes. By ROBERT STEPHENSON, Esq., Engineer. Dated 5th May, 1834.**

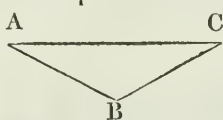
Since the receipt of the memorial to the directors, respecting the formation of railways by undulatory planes, I need scarcely say that I have been so closely occupied, that I found it impossible to reconsider, carefully, the opinions I had formed on the subject several months ago, founded upon some experiments in "The Gallery of Practical Science," with a model prepared by Mr. Badnall. These experiments were considered by several persons conclusive in favour of an undulatory surface for a line of railway.

I drew a different conclusion from them, and made some remarks and calculations at the time, which I considered fully confirmed it. Since that time, I have read the greater part of the controversy, which has been carried on in the "Mechanics Magazine," and paid especial attention to the experiments made upon the Rainhill plane,

* We have received from Mr. Stephenson, in addition to the manuscript now printed, one containing remarks and calculations on the best form for railway bars, &c., the publication of which we propose to commence in the next number.

with several of the locomotive engines belonging to the Liverpool and Manchester Railway Company, without perceiving any reasons for changing the view I originally took.

The following observations are extracted from those above alluded to, as far as appears necessary for explaining the outline of the arguments upon which I had based my views:



A C, a horizontal plane.

A B and B C, two inclined planes completing one undulation.

A carriage, in moving over the inclined plane, may be conceived to be acted upon by

three forces, viz:

First.—Gravity, varying directly as the *sine* of the angle of inclination.

Secondly.—Mechanical force, such as a steam engine, or a spring.

Thirdly.—The uniform retarding force, arising from the friction of the moving parts.

Let n = sine of angle of inclination.

g = force of gravity.

m = mechanical force applied.

f = retarding force arising from friction.

Then the force resulting from the combined action of these three, will be represented by $n g + m - f - (m - f)$; it is evident that the motion of the body is influenced solely by the remaining force $n g$, and is precisely in the same condition as if friction were annihilated.

In this case, it is obvious that the body descending the plane A B, would acquire sufficient momentum to carry it up to the similar plane B C; and were there a series of similar undulations, the body would move forward without interruption, and the velocities in each succeeding undulation would be the same, and the expenditure of mechanical power would be the space passed over multiplied into the retarding force = $s m$, or $s f$, s being the space passed over.

Instead of moving on an undulating surface, let the body be now placed on the horizontal plane A C; its motion in this condition can be influenced by two forces only, viz: the mechanical force m , and the retarding force f . If we suppose, therefore, $m = f$, it is obvious that no motion whatever can take place.

At this point of the comparison, a striking difference, and apparently not an unimportant one, exists between the undulatory and horizontal surfaces. In the former, gravity communicates a certain velocity, which is maintained throughout each succeeding undulation; whereas, in the latter, the forces m and f merely destroy each other; consequently the body remains stationary.

This explains the experiment which was frequently repeated, and in many cases went far to convince several persons of the advantage of having an undulatory surface. Very little reflection, however, is requisite to perceive that this advantage is merely apparent, and not real: for let us suppose that the body at A on the horizontal plane has the mean velocity given to it, which gravity imparts to the body

moving down the first inclined plane of the undulatory surface; it will then move uniformly with this velocity from A to C, and arrive at the latter point at the same time that it would have done on the undulatory line; and however the length may be increased, the body will pass over the distances corresponding to each undulation in the same space of time, whether the surface be undulatory or horizontal.

Let p = power expended in communicating any given velocity to the body on the horizontal surface at A; then the whole power expended in moving the body from A to C, will be $p + sm$, or $p + sf$.

But when the body arrives at C, it retains its original velocity, and is capable of employing its power, or of moving itself beyond C; whereas, on the undulating surface, the body becomes quite stationary at C. In short, it is a well known law in mechanics, that the velocity which the body possesses is exactly equal to the power expended in communicating it; we therefore have the absolute expenditure of power in moving the body from A to C = sm or sf , which is precisely the same result as on the undulating surface.

Hitherto we have the forces m and f equal, by which the friction, or retarding force, was merely neutralized; but in practice m must exceed f , otherwise no motion could ensue on the level plane. When, therefore, m is greater than f , the body will be accelerated by the differences of those forces, viz: $m - f = d$; in this case the motion of the body on the undulatory surface is influenced by a force represented by $ng + d$.

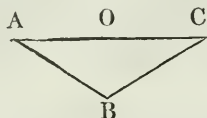
If v and v' represent the velocities generated by the forces ng and d , in the same time, then $v + v'$ will represent the velocity which the joint forces will generate in an equal space of time. But the velocity given by the force ng in descending, is lost in ascending; hence, the body will arrive at the summit of each undulation, with the velocity due to the action of the force d , which is $\sqrt{2ds}$.

Now, the velocity acquired by the action of the force d on the level plane, the body having moved over an equal space, is also $\sqrt{2ds}$; and this equality in velocity must hold, whatever be the nature of the surface over which the bodies move, undulatory or level.

If the body were actually propelled by the force d more efficiently on the one surface than on the other, it must arrive at the point C with different velocities. The readiest mode of showing that this is not the case, is to allow it to expend the momentum by moving along a horizontal plane, or one of a given inclination; in both cases, the momentum is precisely equal. This experiment I repeated several times, and felt perfectly convinced that the results were exactly determined.

It has been urged by some that the undulatory surface has an advantage from the friction being reduced, in consequence of the body being on an inclined surface. A moment's consideration will show that this never can apply in practice, from the smallness of the inclination which is admissible; the reduction in the friction from this cause would be inappreciable.

But even allowing it to operate, the undulating surface is increased in length by a quantity that exactly compensates for the reduction in the friction of the carriage.



Because the diminution of friction is proportioned to the diminution of weight, which is as AB , AO , but the spaces passed over are as $AC : AB + BC$, or as $AO : AB$, exactly the reverse of the former proportion;

showing, that though the friction may be reduced on the inclined plane, the distance is increased precisely in a ratio to compensate it.

The above considerations lead me to conclude that, theoretically, there is neither advantage nor disadvantage in the use of an undulating surface for a line of railway; the question, therefore, resolves itself into one of practical application. This I have frequently and carefully considered, and, generally, with a strong bias in favour of Mr. Badnall's view, because I saw clearly that its introduction would at least reduce the expense of constructing public lines of railway; but I have invariably been compelled to conclude that its adoption would be attended with greater expense in the carriage, greater uncertainty in the operation; in many cases greater inconvenience, and in all greater risk of accidents, than in an horizontal line of railway, or on one approaching to it as nearly as circumstances would permit.

Greater ultimate expense, I conceive, would arise in part from the additional wear and tear, both upon carriages and engines, from the varying velocities which must be continually taking place throughout the whole length of the line of road.

This objection is considered by many of no weight; I need only refer, however, to practical men, who have been in the habit of observing the destruction of machinery where varying velocities are admitted; indeed, I cannot refer to a better instance than Rainhill and Sutton inclined planes, where the objectionable nature of inclined planes is evident to all conversant with machinery, and from whence (it is probably not too much to say) a very large portion of the wear and tear of the locomotive engines on the Liverpool and Manchester Railway has sprung.

The engines on an undulating line must obviously, at the bottom of each undulation, attain a velocity considerably greater than what is required upon an horizontal line, where it may be nearly uniform.

Now, in locomotive engines, this single circumstance gives rise to three separate objections, neither of which is undeserving of attention, and which are distinct from that of wear and tear arising simply out of velocity.

First.—In the construction of these machines, it is a consideration of the very first importance, to proportion and adapt the relative speeds of the different parts to the velocity at which the engines are intended to travel; and though I am perfectly aware that these engines are worked at different rates of speed, I have seen sufficient to convince me that uniformity in the velocities is extremely desirable, and that they never perform so economically as when the intended

velocity is adhered to within very narrow limits, which is quite impracticable on an undulating road.

Secondly.—When the velocity of these engines exceeds that for which they are calculated, the steam acts less forcibly on the pistons, and thus produces an absolute loss of power, or, in other words, an increased consumption of fuel.

Thirdly.—From the present construction of locomotive engines, every different speed of traveling is accompanied with a corresponding increase or diminution of the temperature of the fire, which occasions a continual working amongst the different parts of the boiler, from unequal expansion and contraction, which never fails in a short time to render the boiler more or less leaky.

Every experienced steam engine builder has had instances brought under his observation, of the destruction of boilers by being exposed to great variations of temperature. In all railways, except such as are perfectly horizontal, this objection applies with more or less force. I therefore only mention it in this place to shew the tendency of the undulating railway would be to aggravate the evil arising from great inequalities in the temperature.

These are my principal reasons for concluding that the expense of carriage would be greater on an undulated line, and the same remarks appear to me to lead to the conclusion that there would be greater uncertainty in the operation.

Inconvenience would, in my opinion, result from not having the power to halt at any given point on the line of railway. This may be done without inconvenience on a line of road not possessing inclinations beyond the power of the engines; but where the inclinations of the planes exceed that power, it is clear that some expedient must be contrived to overcome the delay that must ensue. I have only heard of one, which I cannot suppose to have been advanced seriously. I allude to the proposal that an engine, when stopped by any chance on an inclination beyond its power, should be worked backwards and forwards until sufficient momentum be acquired for surmounting the next summit.

This is an operation not only of time, but in many cases would be imminently dangerous, and could not fail to be a continual source of annoyance.

When it is stated that the risk of accident would be increased, it must not be inferred that increase of speed is attended with greater frequency of accident, but rather that such mishaps are likely to be more extensive and serious when they do occur.

I now come to consider more immediately the chief object of the memorial which has been laid before the directors, viz: The expediency of making an experiment on the London and Birmingham Railway, extending over a distance of eight or ten miles, as suggested by Dr. Lardner and Dr. Dalton.

In recommending the directors to make such an experiment, those gentlemen have evidently been influenced by the statement in the memorial that it would not cost over £500, and that the experiment,

should it fail, would be productive of no detriment to the Railway Company.

I have thoroughly considered the expense of such an experiment, and also the probable inconvenience that would arise out of its failure, and supposing the latter result, I am satisfied it could not cost the Railway Company less than £8,000 or £10,000; and this sum may be made to appear without taking into the account many contingencies that would necessarily attend such a circumstance.

The ballasting and laying the rails alone costs from £800 to £1000 per mile, and this charge must unquestionably be incurred in merely transforming the undulated surface to an uniform one. The embankments would require to be brought to a higher, and excavations to a lower, level; thus interfering with the whole of the bridges, over and under the railway.

In short, you could only prepare for the contingency of a failure, by erecting temporary bridges over the railway, throughout the ten miles, until the utility of the scheme had been determined.

These and other considerations, connected with the detail of executing the railway, which it would be superfluous to enter into here, and which it would be impossible to render intelligible in a report like the present, fully convince me that it would be at least rash to advise an expensive experiment on the London and Birmingham Railway, which, in any event, could only save a very small sum in the original expenditure, with the possibility of your not succeeding to your expectations; thus producing a result fraught with mischief to the undertaking generally.

I feel it, however, due to Mr. Badnall, to state that I consider a trial upon some branch road might be made with advantage, as the adoption of his ideas would certainly be productive, in many cases, of considerable saving in the first cost, which, in some branch roads, is of paramount importance.

I must, however, again repeat, that no saving of power could be by any possibility effected.

ROBERT STEPHENSON.

Note relating to the hardening of Lime under Water, by the action of Carbonate of Potassa, &c., and to the hardening of Carbonate of Lime in the Air, by Potassa and Soda. By A. D. BACHE, Prof. of Nat. Philos. and Chem., Univ. Penn.

The following experiments were made more than eighteen months since, and were suggested particularly at the time by the article of Professor Emmett, on the solidification of raw gypsum in the air, by the action of the alkali, potassa, and of certain of its salts. They commenced with an examination of the effect of certain salts of potassa and soda, and of caustic soda, on the hardening of carbonate of lime, and of common lime, in the air; and, by a natural transition, to a more interesting subject, the effect of these, and of other materials,

on the hardening of lime under water. Not having leisure to prosecute this subject, I am induced to publish the results already obtained, that by attracting the attention of some one who may be favourably situated for carrying out the course of experiment which they suggest, it may be carried forward to completion. The conclusions cannot fail to be of interest, both in a practical and theoretical point of view.

It is well known that certain impure limestones yield, when calcined, a lime which hardens under water, technically called hydraulic lime. Experimenters, who have examined these lime-stones, with a view to determine the ingredient giving this hydraulic property, have not agreed in their conclusions; the essential ingredient has been in turn supposed to be silica, alumina, oxide of iron, and oxide of manganese. My friend, Col. Totten, informs me that Col. Troussat, in a recent work on mortars, attributes this power of conferring hydraulic properties upon lime, in certain cases, to soda—an ingredient which, before his examination, had not, I believe, been detected in any hydraulic limestones.

The method of ascertaining the effect of the substances experimented upon, in causing lime to harden under water, was similar to that employed by Raucourt, and described in his work on mortars. The mixture having been made, and brought to a paste of a proper consistency, was placed at the bottom of a glass vessel, and water poured gently upon it. A wire stem, terminated at one extremity by a wooden disk, was placed vertically upon the mixture in the vessel, and the weight ascertained which was required to pierce the mass; the hole thus made being filled up, by tamping the mixture with a blunt stick, it was allowed to remain exposed to the action of the water for any desired length of time, and then subjected again to a similar trial.

As almost all common lime is slightly hydraulic, an examination of that to be used in the experiment was first made; having been slaked, and, when made into a thick paste, placed at the bottom of a wine glass, and water added, the test stem was applied, the mixture having set, bore 1 oz. troy upon the head of the stem; after an exposure of one day, the mass bore $1\frac{1}{2}$ oz.; and after two days, bore $3\frac{1}{4}$ oz.; it had then been so far disturbed, that it would not resume its cohesion.

This common lime was thus shown to possess feeble hydraulic properties. When mixed with sand and water, so as to form a tolerably rich mortar, the mass, after it had set, bore $5\frac{1}{4}$ oz. on the rod, and, after two days, 7 ounces, which was the maximum weight borne. In its mixture with sand, this lime formed a mortar which was feebly hydraulic.

Some of this lime was mixed with caustic hydrate of soda, which, however, had a portion of adhering carbonate. The proportion of soda added was not particularly attended to; it was, however, much less in weight than the lime. The mass became so soft, that when, after tamping in the bottom of the glass, water was added, the test rod penetrated it freely. After one day, the mixture bore 4 oz. troy, upon

the wooden disk at the top of the rod; after another day, $5\frac{1}{2}$ oz., which was the maximum. It recovered this strength twice, by the interval of a day between the times at which it was disturbed by the penetration of the rod. *Soda*, it then appears, renders lime, to a certain extent, capable of setting under water.

Lime being made into a paste, with soda and water, acquired considerable consistency in the air.

When lime was made into a thick paste, with a solution of carbonate of soda, and exposed to the air, it crumbled into dust; this being mixed again with water, assumed consistency at first, but subsequently crumbled.

Lime did not set in the air, when mixed with a solution of sulphate of soda; the incoherent mass was pulverized, and reset with water, which increased the cohesion, but not very materially. Under water, the paste of lime and sulphate of soda, four parts of lime by weight, and one of sulphate of soda, bore 9 oz.; but on the next day lost its cohesion.

Carbonate of potassa, mixed with lime, in the proportion of six, by weight, of the salt, to two of lime, formed a mass which crumbled in the air; but, being reset with water, assumed considerable cohesion.

This same mixture had hydraulic properties; for 4 oz. of lime, 2 of carb. potassa, and 11 oz. of water, being mixed and placed under water, bore, after two days exposure, 64 oz., or $5\frac{1}{3}$ lbs., which was all the weight which was at hand. A mass of the same mixture, which had been exposed to the air, and was but slightly coherent, being placed under water, became quite hard.

An attempt was made, by reducing the proportion of carbonate of potassa to about 12 per cent., to harden the lime in the air; but it did not succeed.

A curious effect was produced by *soda*, and by *potassa*, on *carbonate of lime*, reduced to powder, and, after mixture with alkali and water into a paste, exposed to the air. The carbonate became, in one case, harder than the original material, and in another, but little inferior to it in hardness; in the former case, the experiment was made upon chalk; in the latter, upon Carrara marble. The marble had very nearly the appearance of the original material, and a cast taken from it would have had a beautiful appearance, very different from the dull white of plaster of Paris. Neither of these mixtures was hydraulic; and when a mass of chalk and soda, which had hardened in the air, was placed in water, it was completely disintegrated.

I had, at the time of making these experiments, a quantity of silica, which had been prepared by passing fluo-silicic acid into water, and which, never having been heated, was still soluble, though, of course, in a small degree; after repeated washings, it still restored the red colour of alkanet, which had been rendered purple by a feeble alkaline action. This silica was mixed with lime and water, so as to form a paste, and being placed under water, would not bear the weight of the test rod; it was exposed for four days, and was softer, at the end of the trial, than at the beginning.

NOTES OF AN OBSERVER.

Remarks on Professor Olmsted's Theory of the Meteoric Phenomenon of November 12th, 1833, denominated Shooting Stars, with some Queries towards forming a just Theory. By JAMES P. ESPY.

In the American Journal of Science and Arts, vol. xxv. page 363, Prof. Olmsted has given a very extensive and interesting account of the most beautiful meteoric phenomena of shooting stars, which appeared in the night of the 12th November, 1833. And in the next volume, page 132, the Professor endeavours to prove that "these meteors consisted of portions of the extreme parts of a nebulous body, or comet, which revolves round the sun, in an orbit interior to that of the earth, but little inclined to the plane of the ecliptic, having its aphelion near the earth's orbit, and having a periodic time of 182 days, nearly. That these meteors were combustible, and fell by the force of gravity from the place where they emanated, above the surface of the earth about 2238 miles, and consequently entered the atmosphere with a velocity of 4.1 miles per second." That this great velocity would cause the air before the motion to be condensed, so as to be equal to common atmospheric air at the surface of the earth, when the motion reached within thirty-five miles of the earth. That the temperature of this condensed air would then be 46080 centigrade, according to a formula given by Leslie, whom he quotes as saying, "On account of the increase of capacity for heat which air undergoes by rarefaction, the absolute quantity of heat contained in a given volume of atmospheric air, is the same at all elevations above the earth."

Now, I cannot assent to this theory, because meteors could not fall on the side of the earth most distant from the sun, from any body moving round the sun interior to the orbit of the earth. But the meteors were in the night, and consequently on the side of the earth opposite to the sun, which a body moving round the sun, interior to the earth's orbit, could not be. This objection would not have been fatal, if the Professor had placed the aphelion of his comet exterior to the earth.

Again, these meteors could not have fallen from a comet only 2238 miles from the earth's centre, for then the whole comet would have fallen, even if it had been more than twenty-nine times as far off as the Professor has placed it.

Again, these meteors could not have fallen from a comet, if they had been actuated by the force of gravity alone, for then they would have fallen perpendicular to the surface, which they did not do.

I do not understand whether the Professor means that all the meteors emanated from one point in the comet, or from a space equal to, or larger than, the surface of the earth over which they fell. But in either case they would not correspond with the phenomena, for in both cases they would fall perpendicular to the surface of the earth; and there could be no inference drawn from the radiating point, as it is called, concerning the elevation of the comet from which they emanated. It is known that the meteors pretty generally fell to-

wards the horizon, in such a manner that if their paths were traced upwards, they would all meet in the same point, and this was called the radiating point. This, however, was not the case universally, as will be seen hereafter.

Again, if this radiating point depended on a comet, whose revolution round the sun was 182 days, it could not have been stationary among the fixed stars; for its velocity in its orbit, when it was 2238 miles from the earth, would be about 5000 miles an hour slower than that of the earth. Nor can any comet, whose periodic time is 182 days, appear stationary among the fixed stars in aphelion, whether that aphelion is exterior or interior to the earth's orbit.*

These objections appear fatal to the theory advanced by Professor Olmsted; but there are others also which would of themselves render that theory highly improbable.

It cannot and does not even pretend to account for the meteors, in some regions of the meteoric shower, appearing to move in all directions, horizontally, and even upwards.

It cannot and does not even pretend to assign any reason why the auroral light, which was seen at many places very distant from each other, was not seen at all intervening places, as it should have been if it had been 2238 miles above the surface of the earth. It certainly was not seen at Philadelphia before ten o'clock, as I looked out for it very anxiously, for a reason which will be mentioned hereafter; though it was seen not very far from the city, as will appear from the following statement, which was procured for me by Dr. Emerson, of this city:

"A gentleman in the Delaware bay, about eighty miles south of Philadelphia, observed a cloud of an unusual, round, and well-defined appearance, rise in the west, about seven o'clock on the evening of the 12th November. Its height was inconsiderable, and its length, to use his own expression, did not seem to be more than 200 yards. Soon afterwards, streaks, or flashes, of light began to dart, apparently, from behind the cloud, similar to what we see in the aurora borealis, which it resembled. This illumination continued in a most brilliant manner for an hour or more, when it began to blow with such violence, directly from the cloud, that he was apprehensive the vessel would drag her anchors. The subsequent phenomenon of the meteors was of the greatest brilliancy—the stars, or balls, streaming, and seemingly falling, in every direction."

It is highly probable that this cloud, and the luminous flashes which appeared behind it, were in the neighbourhood of each other, particularly as the luminous appearance was not seen at Philadelphia, and as many such were observed in various directions and elevations, in different parts of the United States.

At Dover, N. H., there was an appearance of the aurora borealis

* Indeed, the aphelion and perihelion of a comet, whose periodic time is 182 days, are two points at which the comet could not, if near the earth at these points, be made to move with a velocity equal to that of the earth. Other points might be chosen in the comet's orbit, contrary to the Professor's assertion, in which its motion would be equal to that of the earth.

early on the evening of the 12th, which continued till four o'clock in the morning, when it suddenly broke out into streams of strong light, spreading into columns, changing into a thousand different shapes, varying their colours through all the tints of the rainbow, and shooting from the horizon almost to the zenith. This scene was followed by a splendid exhibition of fire-works. Luminous balls might be seen darting *about* with great velocity, leaving behind them a train resembling that of a comet. The whole was closed by the formation of a triumphal arch, which vanished before the coming light of morning.—[*Professor Caswell*.

Captain Gideon Parker was in the Gulf of Mexico, lat. 26 N., long. 85½ W., and before three o'clock on the morning of Nov. 13, noticed several meteors, but not more than he had often seen before. Heavy dark clouds hung low in the north-east, from which the second mate, (who held the watch before Captain P. came on deck,) said that the first meteors he saw seemed to break like lightning.

Above the clouds, which were from 15° to 20° high, the sky was clear, and the stars as bright as usual. About three o'clock, Capt. P. first noticed the unusual number of falling stars, and began to count their number, but was forced to desist by their rapid increase. Captain P. observed them for an hour and a half; during that time, they were seen only in the north-east, above the cloud, and the eye at first would take in nearly the whole space of their action, which extended six or seven points along the horizon, and about 45° in altitude; but towards the latter part of the observation the space was extended, say twelve or fourteen points horizontally, and a few degrees higher in altitude.

During his whole period of observation, *not one was seen in the west*, although Capt. P. looked particularly to this fact, and called the mate's attention to it at the time. Captain Parker distinctly remembers a radiant point in the north-east, from which all the courses were directed, some shooting horizontally, some vertically, and others at all inclinations between the two, but none upwards; some shot towards the north, and some towards the east. This radiant point at first held 45° of altitude, but seemed to rise 5° or 10° in the period of his observations, without, however, moving at all from the north-east.

All that descended low enough, passed behind the cloud; not one between the cloud and the observer. All, both large and small, left luminous traces, in which no prismatic colours were observed; and no one of the traces was observed to continue more than two seconds. The afternoon of the preceding day had been squally, and wind variable; but at the time of observation the wind was gentle, from the north-east. At nearly half-past four o'clock, Captain P. yielded the deck to his mate, who states, that soon after he came on deck, the stars appeared passing over from the north-east into the west. In the west, their courses were very short, and they seemed just to let go their hold. The ship was heading south-east. He continued on deck till eight o'clock, A. M. In the meantime, the meteors in-

creased in number, and spread over the whole heavens, and were most brilliant about six o'clock. The sun rose at half-past six.

Now, it is highly probable that all auroral lights—the triumphal arch, the luminous, and even the non-luminous, clouds from which luminous flashes appeared to proceed on that night—were but variations of one and the same magnificent meteoric display; I cannot, therefore, assent to any theory which affords no clue to an explanation of parts of the phenomenon so important. Of luminous clouds, several were seen; one at Poland, Ohio, was visible in the north-east for more than an hour. The Hon. Calvin Pease discovered it, at four o'clock, near the star Alioth, in Ursa Major. It was then very brilliant, in the form of a pruning hook, and apparently twenty feet long, and it gradually settled towards the horizon, until it disappeared. He saw it at five o'clock, when it resembled a new moon, two or three hours high, shining through a cloud; about fifteen minutes afterwards, no vestige of it could be seen. At Niagara falls, also, there was seen, a little after two o'clock, a large, luminous body, like a square table, nearly in the zenith, which remained for some time nearly stationary, and from it were emitted large streams of light.

It is true, Professor Olmsted inclines to the opinion that many of the auroral lights which appeared before and after the 13th, were the comet from which the meteors in question proceeded. But as many of them certainly were not referable to a comet, having appeared, some of them in the south-west, and even in the south-east, and at very different elevations, even in the same neighbourhood, it is very improbable, from this circumstance alone, that any of these lights had their origin in the tail of a comet; and this improbability rises to certainty, when we consider that the same auroral appearance did not present itself, on the same night, all over the United States.

One of these auroras, at least, must have been very low in the atmosphere, on the night of the 12th of June, for it was very faint, and not more than 15° high, at Philadelphia, at 10 o'clock, when, at the same time, it was very bright, and at least 45° high, at Germantown, not six miles distant. Indeed, so faint was it at Philadelphia, that it would not have attracted notice, had I not anticipated it from the state of the dew point; and even after I pointed it out to my friend, Professor Bache, he was at first disposed to doubt whether it was auroral or not, but afterwards yielded assent, though no effect could be detected on the magnetic needle. I afterwards saw the lady who furnishes the meteorological table for this journal, who described the appearance to me as highly brilliant, covering the whole north-west and north, and reaching at least 45° high. The upper part of this aurora could not, therefore, have been more than $2\frac{1}{10}$ miles above the surface of the earth.

This agrees well with the height of auroral arches, as calculated in this journal, vol. xiii. page 294. We shall see hereafter how it agrees with the height of meteoric fire balls. We shall also mention more particularly the aurora of the 8th of March, seen at New Haven, but not at Philadelphia.

Again, I cannot give my assent to the cometic theory, because it cannot account for the curved appearance of many of the largest meteors; it is true, their tracks were generally straight, but on this theory they should all have been so. The following is a description, by an eye witness, of one which was seen in this state; it was given to me two or three days after the phenomenon occurred.

Nov. 13th.—About five o'clock, or a few minutes before, I was standing looking at the meteors, when my attention was called to a very large, bright one, near the zenith, which shot from the north-west towards the south-east. It was very much larger than either of the others, and it was the only one which moved in a serpentine direction; its motion, like the others, was slow enough to trace the direction with ease. But the most remarkable difference between this and the other meteors, was, that after it shot out its full length, there remained a serpentine streak of light, quite as bright as its first appearance, for at least a minute; this streak was a steady, bright light, which neither increased nor diminished for this length of time; after this it began to diminish, and in a short time, a little less than a minute more, nothing remained visible of it but a kind of smoke, or vapour, which gradually changed its form, spreading out and circling up. I am sure the time is not overrated, as it lasted nearly all the time the stage horses were changing, and the vapour was still visible when we started, which must have been at least six or seven minutes after the first appearance. The place of observation was about fourteen miles south of Harrisburgh, on the Susquehanna. The curve was similar to those of a large snake, having several bends, and it did not change its shape or direction during the first minute and a half.

Again, I cannot give my assent to the cometic theory, because there is no satisfactory account given of the manner in which the meteors were ignited. It is true, the velocity with which they are supposed to have entered the atmosphere, by falling a distance of 2238 miles, would have been sufficient to produce a great condensation of the air underneath them, on a supposition that they were bodies of moderate weight and consistency; but this they could not be, as they were supposed to fall from a comet, composed of such light substance as to afford, by its attraction, no retarding influence to the fall of the meteors towards the earth.

But besides this, the Professor has committed a singular error in calculating the degree of heat produced by the condensation of air in the upper regions of the atmosphere. Indeed, so fallacious is the result of the calculation, that I should suppose it was caused by some typographical error, if the whole language of the author did not forbid the conclusion. After quoting a formula of Leslie, for calculating the heat extricated from air condensed, these are his words: "On account of the increase of capacity for heat, which air undergoes by rarefaction, the absolute quantity of heat contained in a given *volume* of atmospheric air is, according to Leslie, the same at all elevations above the earth." The Professor then calculates by the formula, that the heat extricated when the air before the meteor has acquired com-

mon atmospheric density, (which he supposes it would do at the height of about thirty-five miles,) would be 46080 degrees centigrade. "This is the amount of heat which would be extricated by the condensation of air, as it exists at the height of thirty-five miles; but the compression supposed is not that which results from air of this density, but from such as is less dense, commencing from that which is of an extreme degree of rarefaction. The amount of heat, therefore, would be greater than the estimate here made."

Now, one of two things is certain; either Professor Olmsted has mistaken Leslie's meaning, and used the word *volume*, instead of *weight*, in the above quotation, or Leslie was himself most egregiously wrong in his assertion. When the capacity of air is said to be increased by rarefaction, it is not meant bulk for bulk, but weight for weight; and according to the doctrines which prevailed at the time Leslie wrote—first, I believe, taught by Dalton—air, at all elevations, contained the same quantity of caloric, weight for weight. This was known to be true of aqueous vapour, or steam, at all temperatures, and it was thought to be true of all gases; and such, it is believed, is nearly the fact. If this law were strictly true, the temperature of the air, which is stated by the Professor, at 46080° centigrade, would not be 50°, under the most favourable circumstances which could be proposed; for the air at the surface of the earth, when it is of the density in question, never reaches this temperature.

But there is another view of the subject, which shows the absurdity of the above calculation. Whatever increase of temperature takes place in the condensation of air, the same diminution must take place in rarefaction; and therefore, if, by condensing air, taken at the elevation of thirty-five miles, into air of equal density as that at the surface of the earth, its temperature would be increased 46080° of the centigrade scale, its temperature would be diminished the same number of degrees by restoring it to its former state of rarefaction. Or, in other words, if a portion of air at the surface of the earth, at zero, were rarified 1024 times, its temperature would be 46080° centigrade below zero; and if this air, so rarified, were raised in temperature to zero, and then condensed into common atmospheric density, its temperature would be 46080° centigrade.

If this were really the case, nothing would be more easy than, by means of rarefying, and then condensing, the air, to produce a temperature many thousand degrees both higher and lower than has ever yet been obtained.* The exact law of increase of temperature by the condensation, of air varying in density, at the commencement of the experiment, has not, so far as I know, been ascertained. Mr. Ivory says, that if air at common density be condensed into one-half the space, its increase of temperature will be 90° Fahr. But it is known, that if air of less density is employed in the experiment, the increase of temperature will not be so great; how great, is not precisely known; but if we reason from the analogy of steam which is known, when air of half

* It is indeed not a little remarkable, that Mr. Olmsted never seems to have thought of the temperature of the air at the beginning of the condensation; he certainly nowhere mentions it.

the density is employed in the experiment, and condensed into half the space, the increase of temperature will be only 78° . For if steam, at common atmospheric pressure, be doubled in density, its increase in temperature is about $37\frac{1}{2}$; whereas, if steam, at half atmospheric pressure, is doubled in density, its temperature is increased only $32\frac{1}{2}$ — $\therefore 37\frac{1}{2} : 32\frac{1}{2} :: 90 : 78$ = to the increase of temperature which air at half atmospheric density would have, if its density were suddenly doubled.

Again, I cannot embrace the cometic theory, because it does not account satisfactorily for the remarkable change of temperature which accompanied the phenomenon. The Professor, it is true, mentions as a possible cause, that “the air descended in large quantities from the regions of perpetual frost.”

In making this statement, Mr. Olmsted must have entirely forgotten the result derived from Leslie’s formula—that air brought down from the upper regions of the atmosphere, and condensed into common atmospheric density, would have a temperature of 46080° centigrade; upwards of 78000° Fahr. The probability is, that if air were brought down from any elevation to the surface of the earth, its temperature would be greater than the air at the surface; for as there is a great deal of latent caloric given out by vapour in the region of the clouds, when rain is formed, and as this caloric is absorbed by the air,* then it follows, that each pound of air, in that region, probably contains more caloric than a pound of air at the surface of the earth. This probability is rendered almost a certainty, from the following fact. Gay Lussac ascended into the air 7600 yards. He found that the air at that elevation was exactly one-half the density of that at the surface of the earth, and the temperature had fallen 72° of Fahr. But it has been shown in the foregoing, that if air of common density was suddenly rarefied to one-half the density, it would probably be reduced in temperature 70° . One thing, however, is certain, independent of all experiment: that air being brought from upper to lower regions, would not be colder than the air into which it was brought; for if it was, the atmosphere would be in a state of unstable equilibrium, and a vortex would be formed of cold and heavy air from the upper regions downwards, which would never cease till the atmosphere was inverted, the lower air, having the most caloric, taking the place of the upper, and the upper taking the place of the lower. This is not the constitution of the atmosphere, yet we will show here after some extreme cases, where vortices will be formed both up and down. In short, if Dalton’s theory is correct, no change of temperature at the surface of the earth would take place, by air from the upper regions being forced down by meteors; and if Ivory is right, a small increase of temperature would take place. A sudden production of cold, therefore, is *not* an effect which would follow, of course,

* Sufficient in a rain of one inch to heat the whole upper half of the atmosphere 20° Fahr., on a supposition that the capacity of air is 1.4, and the latent caloric of steam is 1000.

from the descent of large quantities of air from the regions of perpetual frost.

The Professor observes, in a note, that "the heat extricated by condensation might be supposed as equivalent; but this, when produced by sudden compression, would not heat a gaseous medium, which is the worst of all conductors of caloric, but it would escape by radiation."

This explanation is altogether unsatisfactory, for it is the gaseous medium itself which is heated by compression; and besides, we have reason to believe that air is quite as bad a radiator as it is a conductor of caloric; for Dr. Wells says he has seen a thermometer 16° lower, at the surface of the ground, a little after sunset, than one placed only a few feet above it; and I have seen a difference of 11° in similar circumstances, which could not be, if air was a good radiator; for in that case the air would become cool, by radiation, as soon as the surface of the earth. Indeed, we are led to believe that air is almost a non-radiator, when we consider that in a calm, clear night, air at the height of twenty or thirty feet, will remain for hours at nearly a constant temperature of eight or ten degrees above the temperature of the surface of the earth, and 100° above that of the celestial spaces; for the temperature of the celestial spaces is probably a little less than the lowest temperature ever witnessed on the surface of the earth, as it is not likely the surface of the earth would cool down by radiation, quite so low as the temperature of the space surrounding it. Fourier, by a profound investigation, makes this temperature 57° or 58° below zero of Fahr. But even if the Professor is correct in principle, when he asserts that air brought down from the regions of perpetual frost will diminish the temperature at the surface of the earth, it would not apply to the present case, unless we suppose the effect prior to the cause; for in almost all instances, the temperature had sunk rapidly many degrees, previous to the meteoric shower, which was alleged to be the cause of the descent of large portions of the atmosphere.

Mr. Olmsted is not more successful in his attempt to explain the west wind which prevailed. He says, that "so great a number of bodies, some of which, it appears, were very large, falling through the atmosphere, with so prodigious a velocity, must have produced extensive derangements in the atmospheric currents. The first effect was a westerly wind, which suddenly *succeeded* the meteoric shower, in nearly every place where the shower prevailed. Large volumes of air, suddenly driven from the upper to the lower regions of the atmosphere, must have a relative motion eastward, since the velocity due to their greater distance from the earth, derived from the diurnal motion, would not be instantly lost on their descending to a lower level. In our latitude, a body of air descending suddenly to the surface of the earth, from the height of twenty miles, would have a relative velocity eastward of five miles per hour." Now, it is very remarkable that almost all the authorities referred to by the Professor, directly contradict his statement that a western wind *succeeded* the meteoric shower; they say this wind *preceded* it.

Alex. C. Twining, of West Point, says there was a moderate breeze from the north-west; the day *preceding* had been marked by violent gusts of westerly wind, one of which threw over and sunk, opposite to this place, a two-masted vessel, with such suddenness, that all on board perished. The Professor's own observations are, that *on the 12th a high westerly wind prevailed by gusts*. Dr. Humphreys says that at Annapolis, Md., the wind at first, on the 12th, blew from the south, but veered suddenly, and for the rest of the day was quite fresh from the north-west; at the time of the meteors, the air was tranquil; on the 13th, it blew from the south, nearly as strong, but not so cold. At Charleston, S. C., the wind *continued* from the *north-east* during the 13th. At Buffalo, the winds, which had been very heavy for many hours, had abated considerably. At Poland, the weather, which had been mild, at the approach of evening, on the 12th, became clear, and so cold, that before morning the mud froze in the streets.

Mr. Palmer, near New Haven, says that the wind was west on the 12th, at six o'clock; at seven, it was south-west, accompanied with a reddish vapour, which gradually rose up to the zenith, and prevailed during the first part of the meteoric display. From three till four, the air was still; at four, a strong gust of wind blew for a short time from the north-west, and immediately afterwards the meteors increased astonishingly; these gusts returned at moderate intervals with less and less force, each time occasioning a perceptible increase of meteors. Dr. Ashbel Smith, of Salisbury, North Carolina, describes the air as becoming more dry and harsh during the meteoric display. This state of it, he says, rapidly increased, and, on the 15th, it was very keen and cold, with high dry winds. These are the chief authorities to which Mr. Olmsted refers, to prove his assertion that a western wind suddenly *succeeded* the meteoric showers; not one of which gives the slightest countenance to such an idea. But is the principle itself correct? If large masses of a comet, just such as the Professor describes these meteors to have been, were to fall through the atmosphere, bringing down with them large quantities of air, from the highest regions of the atmosphere, to the very surface of the earth, would this produce a western wind? Most assuredly not; for these foreign masses entering our atmosphere, without partaking of the rotary motion of the earth, would incline towards the west in their descent, and, by their inertia, put the air in motion, and thus cause an *eastern* wind.

Now, as the meteors over a large extent of country did actually slope towards the north-west, and as no south-east wind was produced, this is an absolute proof that no foreign bodies of sufficient weight and consistency to drive the air before them, down to the lower regions of the atmosphere, did fall from a comet, or any other body, into the air, during that memorable night.

If it were possible to imagine a portion of air brought down from the height of twenty miles to the surface of the earth, through a vacuum, it would be found moving five miles an hour easterly, as the Professor says; but as this could not be in fact, and as the only thing

possible in this case is to suppose that air descended through air, and that as much ascended as descended, and that this ascending air would have as much motion westerly as the ascending air has easterly, we are compelled to acknowledge that these two motions would counterbalance one another, and thus no horizontal wind would be produced by the simultaneous transfer of air from the upper to the lower, and from the lower to the upper, regions of the atmosphere. And that the transfer is simultaneous when air comes down, is manifest; for if any portion is forced down, this will force an equal quantity up, however great or small this portion may be.

But there is another circumstance which, of itself, completely refutes the notion, that these meteors were foreign bodies, falling into the atmosphere by the force of gravity, and condensing the air before them so as to produce ignition.

For if this had been the case, the velocity of the meteors would have diminished constantly from the moment of their first appearance till their final extinction; because the air, at the moment of inflammation, must have been condensed at least seven times beyond that at the earth's surface; M. Collardon, *Repertoire de Chimie*, says thirteen times, for even spunk in the fire pump does not ignite with a less density; and consequently it must have been pressed upwards with a force of at least seven, perhaps thirteen times, fifteen pounds, to every square inch of its under surface; and this great pressure would, most undoubtedly, have rapidly diminished the meteor's velocity, even if its density and specific gravity had been much greater than they were supposed to be. Therefore, as the velocity of the meteors, at least generally, was uniform, till the very moment of their extinction, they could not have been bodies falling, by the force of gravity, and condensing the air before them. And indeed, if it did not appear invidious to assign more reasons on this point, when enough have been given to disprove the theory, it would be easy to show that if the velocity of the meteors was as great as the Professor calculates them to be, they could not have entered very deep into our atmosphere, before the density of the air before them would have been fifty, or even one hundred, times greater than that of common air at the surface of the earth; so that, unless the meteors were much denser than they were supposed to have been, they would have been thrown upwards again with considerable velocity, by the reaction of the expanding air. This effect will be admitted the more readily, when it is considered that the meteors became lighter and lighter from combustion, till the very moment of their extinction. Besides, it is known—so says Mr. Adams, in his *Natural Philosophy*—that light bodies, such as mustard seed, when discharged from a musket, with strong powder, sometimes fly back in the discharger's face; and the velocity of the meteors, if they fell 2238 miles by the force of gravity, must have been eight or nine times greater than that of the mustard seed.

From the reasons assigned, then, we may safely infer that *the meteors of the 13th November, 1833, were not bodies falling towards the*

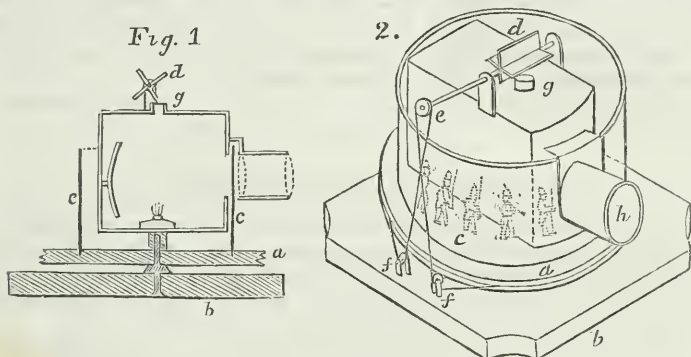
earth by the force of gravity, neither from within, nor from without the atmosphere.

[TO BE CONTINUED.]

Description of an improved form of the Slides for Magic Lanterns.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—I send you a description of an improvement in the Magic Lantern, made by me in 1825, an account of which has not been published in any work. By a slight alteration, the common form of lantern may be adapted to them. In the accompanying figures similar parts in each are explained by the same letters of reference.



The pulley, *a*, should be larger than the bottom of the lantern; the arbour around which it works is secured to the base, *b*; and after passing through the pulley, is received in a socket fastened to the bottom of the lantern; on this pulley there is placed a band of glass, *e*,* which is kept in its place by fitting into a groove turned in the upper side of the pulley; the figures to be exhibited are painted on the glass, in the same manner as those on the common slides. On the top of the lantern, a fan, *d*, is placed, so that the leaves on one side of the centre will be acted upon by the rarefied air passing up the chimney; at one end of the spindle of the fan, there is a small pulley, *e*, over which an endless cord passes, and connects it with the pulley *a*; the intermediate pulleys, *f f*, are for the purpose of changing the direction of the cord, so as to admit of it passing around *a*.

Now, it is evident, that when the lamp in the lantern is lighted, and a current of heated air passes up the chimney, the fan will revolve, and motion will be communicated to the band of glass on the pulley, *a*; and that the figures will be represented (on the screen) in succession, as they are painted on the glass.

In exhibiting, to give the greatest effect to the deception, have a hood placed over the lantern, with a cord leading from it over pulleys, fastened to the ceiling at a back part of the room. When the

* The bands of glass may, of course, be as large in diameter as it is possible to procure them, and the pulley made of sufficient size to suit them.

audience are seated, and the lights extinguished, by raising the hood quickly, it will appear to those not in the secret, to be the work of enchantment. As soon as the figures have all passed, lower the hood over the lantern, change the band of glass for another, and so on to the end.

The above arrangement admits of a more perfect action than the old plan; for instance, there may be a stationary slide, with a road, &c. painted on it; and on the band of glass, a troop of horse may be represented, which will have the appearance of travelling over the ground; the effect may be heightened by the under side of the pulley, near the periphery, being fluted in radii, by fixing a pin directly under the tube of the lantern; the pulley, in passing over it, will receive an undulating motion, which will be communicated to the figures on the glass. Fig. 1st, is a longitudinal section, taken through the centre. Fig. 2d, a perspective view of the lantern and its appendages.

Yours respectfully,

A. C. JONES.

Alleged Error in Arnott's Physics.

The Journal of the Franklin Institute would have an increased interest if it contained more original matter. It has obtained a standing rather too "correct and proper," for those who are not veterans in science to adventure their speculations. With this impression, and hoping that this will be noticed, I submit the following.

There are (as I conceive) several erroneous positions taken in "Arnott's Physics." That now presented may be found at page 134, Carey & Lea's edition of 1831. It is there stated, that "when any elastic body, as a billiard ball, strikes any other body larger than itself, and rebounds, it gives to that other body, not only all the motion which it originally possessed—this being done at the moment when it comes to rest—but an additional quantity, equal to that with which it recoils." Also,

"This phenomenon constitutes the paradoxical case, of an effect being greater than its cause, and has led persons imperfectly acquainted with the subject, to seek from this principle, a *perpetuum mobile*."

In opposition to the above, I contend, that when any elastic body strikes any other, larger than itself, and rebounds, it does not give to that other all its motion, by just so much as it *does* rebound.

Will some of your readers show that Dr. Arnott is right, and that I am wrong?

T. W. B.

Cincinnati, 8th Oct., 1834.

Our respected correspondent is *certainly* wrong in his complaint of a want of original matter in a journal, more than two-thirds of each number of which are thus occupied; he must strangely have overlooked the valued labours of the editor, in his monthly remarks upon patents. We *trust* that he is also wrong in supposing that a journal intended to give useful information to mechanics, can possibly attain a stand-

ing too "correct and proper" to meet their encouragement, and that they would desire its scientific tone to be lowered. COM. PUB.

FRANKLIN INSTITUTE.

Monthly Conversation Meeting.

The second conversation meeting of the Institute, for the season, was held at their Hall, Oct. 23d, 1834.

Messrs. Carr & Lunt exhibited a variety of articles, of excellent workmanship, or of ingenious construction, consisting of a ship's windlass, invented by Walker & Badger, of Portsmouth, New Hampshire; two rack wrenches, manufactured by H. Foote & Co., of Springfield, Mass.; specimens of manure forks, from the same manufactory, remarkable for their excellent temper; and samples of wood screws, by J. G. Pierson & Brothers, of New York—beautifully finished articles, which were pronounced by persons, who are in the practice of using them, as equal to the best specimens ever exhibited in this country.

Mr. L. Hammond, of Middletown, Connecticut, showed a safety door lock; the letter principle being applied differently from the similar one in Perkins' lock. The bolt is secured by tumblers inside, and can be released by drawing some of a series of pins, of which there are twenty-four, marked with the letters of the alphabet. The lock may be set to any letter or word, and can be locked, or unlocked, only when the pin, or pins, corresponding to that letter, or word, are withdrawn.

Mr. Joseph Nock, of Philadelphia, brought forward a safety chest lock, which was admired for its ingenuity and workmanship.

Prof. A. D. Bache presented to the meeting, in the name of Mr. Thomas Ewbank, of New York, a metallic syphon, of the form described by Mr. Ewbank, in the Journal of the Institute, vol. xiv., page 367, and showed its application as a cock, or as a gauge, pursuant to the views of the inventor.

A galvanic battery of four elements, the invention of Mr. John W. Draper, of Christiansville, Virginia, was exhibited, and its decomposing powers illustrated. This battery is described in the Journal of the Institute, vol. xiv. page 289; and the conditions of most powerful action, as determined by the inventor, were stated by Prof. A. D. Bache.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. J. D. Woodside's Revolving Harrow and Seed Cart.

The Committee on Science and the Arts, constituted by the Franklin Institute, of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination, a revolving Harrow and Seed-cart, invented by Mr. James D. Woodside, of Washington city, District of Columbia,

REPORT:—

That having examined a model of the machine, and inspected nu-

merous certificates of its performance, which have been given by agricultural gentlemen, they are of the opinion that this is a valuable improvement in that necessary implement of husbandry, the harrow.

Some of the committee were present during a trial of one of these machines, the result of which was highly satisfactory. It seemed on that occasion to require more power to move it than the common harrow; but its superior efficacy in eradicating weeds, and pulverizing the soil, will, it is believed, more than compensate for this difference, as it will certainly do more work at one operation, than the common harrow will at two or three.

Another advantage which it possesses, is, that it is not so liable to be clogged or choked by weeds, and clods of earth, as the common harrow. These are collected by the latter; and wherever the harrow is raised to clear it of them, there remains a heap of rubbish, which impairs the evenness of the field, and injures the crop.

The committee have not had an opportunity of seeing the seeding apparatus in operation; but from an inspection of it, they believe it will be found to answer very well for smooth and heavy seeds, such as clover seed, and wheat or rye, as it will, if properly regulated, distribute them more evenly than can be done by hand.

Accompanying this report, is a description of the machine, which has been furnished by the inventor.

By order of the Committee.

Oct. 9th, 1834.

WILLIAM HAMILTON, *Actuary.*

Description of Mr. J. D. Woodside's Revolving Harrow and Seed-Cart.

In the construction of my harrow I use a cylinder of about six inches in diameter, made of any solid wood, equal in length to the distance of from face to face of the hubs of the wheels of a cart, to which it is attached. The cylinder moves on gudgeons, passing through the arms of a frame, the four ends of which rest on the end of the iron axle projecting beyond the hubs. This frame is forced back from the cart wheel by a nut on a bolt, which enters the end of the arms of the frame, for the purpose of tightening the chain band, which passes over the band wheel, secured to the spokes on the inner side of the cart wheel, having a V groove to receive the chain. Near each end of the cylinder is a cast iron cylinder, with a V groove of about eight inches diameter, in which the chain plays with a cross, which gives the cylinder a counter motion to that of the cart wheel. The circumference of the band wheel on the spokes of the cart wheel being about 128 inches, and that of the cylinder wheel 24, gives six revolutions of the cylinder to one of the cart wheel; consequently, the teeth on the cylinder (39 in number) move with a rapidity which roots up all kind of weeds, such as crab grass, wire grass, vines, &c., and, at the same time, pulverizes the earth most effectually, to the depth of six inches or more, the length of the teeth. By placing the chain band over the wheels, without the cross, the cylinder will, of course, revolve with the cart wheel; and as it makes six revolutions to one

of the cart wheel, the cylinder, weighing 250 lbs., acting as a roller, tends to mash the clods of earth, which the teeth in revolving cut and lighten up, in a very effectual manner. In working the implement without the cross in the band, it does not require much power, but it is evidently not so effectual in destroying weeds, &c. There is a contrivance for elevating the harrow or cylinder, for passing over stumps, &c., by means of a windlass. The grain is distributed from the cart by a sieve of sheet iron, in the form of two spouts, having a descent each way, from the centre of the cart in front, and passing under the shafts, extending as far out as the cart wheels. To these spouts, or sieves, which are perforated to suit the size of the grain to be sown, is connected a mouth-piece of leather, in the upper end of which is a square frame of iron with a bolt thus, | which bolt enters the front board of the cart, and suspends  the sieve. A hopper, with a leather mouth-piece, placed inside of the cart, conveys the grain to the sieve, which is always full while any grain is to be seen in the hopper. The grain is shaken through the sieves by means of a cog wheel, which strikes the ends, and are revolved by a band which passes over the hubs of the cart wheel, and the two cog wheels on each side of the cart. The faster the cart moves, the faster the grain falls; and the quantity to be sown to the acre, is regulated by the number of holes in the sieves.

The harrow and seeding apparatus can be attached to, and detached from, the cart in five or ten minutes, so that the cart is always at service for other purposes.

Gentlemen of the Committee,—This explanation of my harrow, &c. I hope will prove satisfactory, and enable you to make your report. As the two gentlemen who were present on the 26th instant, when the harrow was in operation, were of opinion that the implement required much power, I must beg leave to remark that I was harrowing ground six inches deep, which had only been ploughed to the depth of four inches, and in addition to which, the shaft horse received but little aid from the leader. I am willing to admit that my mode of harrowing requires more power than the common harrow, and I think my harrow is richly deserving of more power, as it does the work far, very far, superior to the implement heretofore used for that purpose. As regards the common harrow, I consider it a very rough, inefficient affair, which merely scratches two or three inches of the surface of the earth, covering the clods, but not breaking them; this has been fully proved, by passing my harrow over after it. I am fully persuaded that with three horses, and one hand, I can do more work than six of the old-fashioned harrows, and in better style.

I make these remarks, not by way of boasting, but from a conviction that the common harrow cannot, from the nature of its movement, compete with mine.

Very respectfully,

Your ob't. serv't.,

JAMES D. WOODSIDE.

Philadelphia, Sept. 27, 1834.

Report on Mr. John Pierpont's Fireplace.

(WITH A COPPERPLATE.)

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination a Stove, or Grate, denominated the "Doric Fireplace," invented and patented by the Rev. John Pierpont, of Boston, Massachusetts, and assigned by him to Jos. L. Lord, Esq., of Taunton, in that state, REPORT:—

That the stove, or grate, under consideration, claims to furnish, according to the words of the patentee in the specification, "a new and useful method of warming and ventilating rooms, by burning anthracite, or other coal, in an open and portable fireplace, or stove, which I call the DORIC FIREPLACE; which may be made in a variety of different forms, but in every form must be constructed and arranged upon the principle of *supplying to the room that is to be warmed and ventilated, in lieu of the air that, through the smoke flue, or chimney, passes out of it, and that by the operation of the fire itself—an equal quantity of fresh air from without the room, which, as it comes in, is warmed by being made to pass over or between the heated surfaces of bodies not metallic; or, if metallic, bodies that have not been brought into contact with a burning substance.*"

The apparatus is denominated the DORIC FIREPLACE, because the inventor has preferred to construct it with Doric columns, and to give to its other parts a form corresponding with that order of architecture, as represented in the plate herewith presented. It is observed, however, in the specification attached to the patent, which has been placed in the hands of the committee, that "although this simple form is preferred, from a belief that its beauty consists in its severe simplicity, it may yet be varied in this respect; and that the columns, or indeed any other part of it, may be ornamented with brass, polished steel, or other material, according to the taste of the manufacturer, or the purchaser, without departing from the principle upon which the fireplace is constructed."

Fireplaces and stoves have been frequently constructed, in which air from without the apartment to be warmed, is admitted to circulate between plates heated by the fire, and thence to pass into the room, to supply the place of that which passes through the fire, and up the flue; but the committee is not aware that this has been effected, without allowing the air so admitted to come into contact with metallic plates, heated by contact with the fire; the accomplishing of this object is the characteristic feature of the Doric Fireplace.

The stove, with the exception of the lining, is, in preference, constructed entirely of cast-iron; but the fuel, which is contained in an open grate, is not in contact with the metal, excepting with that portion of it which constitutes the grate bars. The back and ends of the chamber of combustion are formed of fire brick, moulded for the purpose. This fire brick is kept, by suitable ledges, from contact with the metallic plates which form the shell of the stove, so that the air

PATENT



DORIC FIREPLACE.

cylindric shape, while exposed to the pressure of the water. One of these tubes communicates with the interior of the helmet, by a pipe opening near the mouth of the diver; this tube is for the supply of fresh air, which is thrown in by a forcing pump, worked by an assistant, who follows, in a boat, the motions of the wearer of the dress. The other tube opens at the top of the helmet, and is for the escape of the air vitiated by respiration. The contrivance for regulating the escape of the air is very simple and ingenious, and, the committee believe, entirely effectual: in the escape tube is a part, just above the helmet, which is flat, or formed of two simple folds of elastic cloth, or of leather; the sides of this portion being pressed together by the water, no air can escape, until the pressure of the air forced into the apparatus is greater than that of the water in which the tube is immersed, when the doubling will open of itself; should the supply of air be inadequate at any instant, this doubling may be closed by the hand of the diver. The whole dress is inflated by this arrangement, and the disagreeable effects of the contact of the cloth, and the pressure of a non-elastic fluid, are prevented. The hands are protected by gloves covered with gum elastic, and forming part of the dress; the hands and arms are thus at perfect liberty for motion. The feet are protected by sandals over the dress, and stability insured by weighting the sandals with lead. The place in which Mr. Norcross made his experiment in this city, was unfavourable to ready motion, the bottom of the river consisting of very soft mud; but he was able to change his place with considerable rapidity. The committee were entirely satisfied with the apparatus, and with his management of it, and believe that it may be used with great advantage in many cases, where examinations are to be made, or operations to be conducted under water.

In regard to the novelty of the invention of Mr. Norcross, the committee are not so fully informed as in relation to its efficacy. Similar devices have been applied in conjunction with, and without, the diving bell; and in one case of a successful experiment in England, that of Mr. Bell, at Yarmouth, the material of the dress, and the general features of the apparatus, were similar to the corresponding parts as used by Mr. Norcross. A similar dress has been patented by Mr. N. Wolcott, of Delaware, and by Messrs. F. Smith and L. S. Steele, of Virginia. The committee do not know the nature of the minute details of the apparatus in either of the cases referred to.

By order of the committee.

Nov. 13th, 1834.

WILLIAM HAMILTON, *Actuary.*

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JUNE, 1834.

With Remarks and Exemplifications, by the Editor.

1. For *Zinc Cans for Cotton Roving*; William A. Crocker, Taunton, Bristol county, Massachusetts, June 3.

The patentee says, "My invention, or improvement, consists in the substitution of sheet zinc for tin plate, the material heretofore universally employed for that purpose. In all other respects, excepting in the material employed, the cans are similar to those now in use; and the manner of soldering the sheets together, of putting in the bottoms, and of strengthening them with rims, or hoops, is such as is well known to the workers in metals. What I claim, therefore, as my invention, is a *new manufacture* of cotton cans, by making them of sheet zinc, a material not before used for that purpose."

2. For a *Chain Saw, for sawing timber, &c.*; Phineas P. Quimby, Belfast, Waldo county, Maine, June 3.

This is a saw which stands a fair chance of being unique in its character, as we are of opinion that not more than one of the kind will ever be brought into existence. It is to consist of links put together like the fusee chain of a watch, which links are to have teeth inserted into, welded, or otherwise affixed to them; these teeth are to widen at their points, to enable the saw to clear its way. The links are to form an endless chain, which is to pass over two pulleys, placed one above the other. The carriage that is to sustain the article to be sawed, has in it some novel contrivances, which are particularly described and claimed; as this part, however, is only of secondary consideration, we do not think it necessary to dwell upon it, viewing, as we do, the principal thing in the whole instrument, the saw, as utterly worthless.

Were we to attempt to urge all the objections to this contrivance which present themselves, we should fill a large space to little purpose, as we think that no practical man, who knows what is necessary to a well-operating saw, will need any argument to convince him that, however well this chain saw may be made, it will still be a very shackling affair, operating very indifferently at the best, making a kerf of unnecessary width, be extremely liable to get out of order, costly in its construction, &c. &c.

3. For a *Cooking Stove*; George J. Prentiss, Smithfield, Providence county, Rhode Island, June 3.

The description of this stove is signally imperfect; we are told, however, that it is "to burn anthracite coal, with a circular revolving oven, made of cast iron, resting on the centre at one end, and on two wheels at the other. It may also be made of sheet iron, and cased with a lining of tile, or fire brick. The exterior part of the oven, when overheated, is turned by means of a crank, so that the heat may be applied, when necessary, to its cooler parts." According to the drawing, the oven is to be placed towards the back of the stove, and is to consist of an exterior case, which is stationary, and an interior, cylindrical, revolving oven, about one-fourth part of the circumference of which is exposed to the action of the fire. There are shelves within it, upon which the articles to be baked are placed, and which are to remain at rest during its revolution; how they are

to be fixed, we are not informed, but could certainly invent a mode of doing it.

There is no claim made, but dependence is manifestly placed upon the revolving oven, which, however good it may be, is, unfortunately for the patentee, not new. In the year 1826, the Franklin Institute offered a premium for a cooking stove, in which anthracite coal should be burnt; and this was awarded to Mr. Joseph R. Page, of Philadelphia, who obtained a patent for his stove, on the 24th of March, 1827. The oven consisted of a rotary cylinder, different sections of which might be exposed to the fire, exactly as in that above described, the articles which were being baked remaining at rest upon the shelves or bars used to sustain them. The patentee was not a stove maker, and not so situated, therefore, as to bring this stove into general use, and its merits were, probably, never fairly tested, excepting by himself.

4. For a *Machine for Manufacturing Horse Collars*; Ebenezer Whitney, Chenango, Broome county, New York, June 4.

A cast iron mould is made, of the size and form of the inside of a horse collar, and this is to be securely bolted on to a horizontal bench. The collar, after being stuffed, is to be placed upon this mould, and drawn close to it by means of a rope which is passed round it, the rope being tightened by a screw affixed to a vertical post, opposite to the pointed end of the mould. When the collar is thus secured, a few blows of a mallet will, it is said, cause it to take its proper shape.

5. For a *Triple Elbow, or Rafter, Press*; Robert Bradley, city of Natchez, Mississippi, June 4.

This is a sort of toggle joint press, intended principally for pressing cotton, hay, or other articles, into bales. The follower is to be brought down upon the bed-piece by straightening the toggle joints, which straightening is to be effected by blocks and tackles, drawn tort by passing the end of the rope round a drum, or by other suitable means; but, however operated upon, the patentee "claims the exclusive privilege of working it."

We do not perceive any thing in the arrangement of this press, calculated to ensure a preference to it over many others already in use.

6. For a *Thrashing Machine*; James D. Emes, Lansingburgh, Rensselaer county, New York, June 4.

The claims set up in this case are to "the cast iron cylinder, with its bevilled beaters, as described, securing the operation of separating the straw in a shifting position, when under the operation of thrashing. Also, the concave commencing with a roller, which may, or may not, be dispensed with; and the slats or bars as described, to continue and finish the concave; and also the feeding motion, so far as the two rol-

lers are concerned, together with the free roller in the pitch board."

We have heard of such a thing as "darkening council with words without knowledge;" and in reading the specification, one might be tempted to believe that it was intended as an illustration of the process in the mind of the writer of the foregoing quotation. The description of this machine is a story of great length, consisting of many well-filled pages, over which we have carefully looked, in the hope that we might discover a discovery; but, alas! all to no purpose. We have, it is true, met with some new terms, the meaning of which we have guessed at by the context; but as to any thing novel in the machine, if it exist, it is too recondite, or transcendental, for us.

7. For *Mills for Grinding Corn, or other Grain*; Samuel M. Handy, John Albee, and Enoch B. Cutts, Hallowell, Kennebec county, Maine, June 6.

"A cylindrical stone," which *cylinder*, by the by, is the frustrum of a cone, about sixteen inches long, and fourteen inches in diameter at one end, by twelve at the other, is to be enclosed between two other stones, each of which is excavated to receive one-half of it, and to admit the spindle by which it is to be turned. There is also an opening for feeding the grain, and another for the exit of the meal. Of the frame, we need not say any thing; there is nothing particular in its form or substance, all the presumed novelty in the machine consisting in "the peculiar form of the stones," which, with the "particular application of said stones, and their arrangement," constitute the claim. This invention, it appears, is tripartite, each of the inventors having contributed his share of knowledge to bring it to perfection; and as the claim consists of three simple items, we suppose that one of the parties contributed the "form of the stones," another their "application," and the third their "arrangement."

Should this contrivance not very far surpass our anticipations of its utility, we apprehend that neither of the gentlemen concerned will grow rich upon one-third of the profit to be derived from it.

8. For a *Machine for Adding*; Daniel Kohler, Sunbury, Northumberland county, Pennsylvania, June 6.

In the volume of the "*Machines Approuvées par L'Academie Royale*," there is a considerable number described for performing operations in arithmetic, and we could point to many others of more recent date. Judging, however, from the universal fate of such machines, we conclude that they have generally led to the road "round Robin Hood's barn," for we have never seen one, excepting in the collections of some learned societies, where they are deposited as articles of curiosity. We are apprehensive, therefore, that the present patentee has expended a portion of thought and money upon his contrivance, for which he will never be rewarded, either in pelf or in fame. The machine operates by means of wheels and pinions, and the sums added are pointed out by indices. We do not think that we

should perform a service acceptable to our readers, by attempting a description of it, more especially as the patentee has neglected to tell in what particulars its novelty consists, having made no claim, and the whole affair being treated as though the Abacus and Babbage's machine, with all the contrivances intermediate in merit and in time, had never existed.

9. For an improvement in the *Manufacture of Oakum*; Ebenezer Cook, and Selden Usher, Haddam, Middlesex county, Connecticut, June 7.

Oakum, it is remarked, has hitherto been manufactured from old junk, or rigging, or from new rigging, or yarns spun and tarred for that purpose; but the patentees state that they have discovered that the requisite quantity of tar can be incorporated with the fibres of tow, hemp, or flax, without the necessity of previously spinning it. The process consists simply in immersing the materials in a kettle of heated tar, and expressing the superfluous portion in a press of any construction. The patentees broadly "claim as their joint discovery and improvement, the principle that the proper quantity of tar can be incorporated with the material of which oakum is intended to be made, whether hemp, flax, or tow, in its dressed state, without first twisting or spinning the same; whether effected in the mode aforesaid, or in any other manner."

We are not aware that this mode of preparing oakum has been practised, but from the simplicity of the process, and the extensive use of the article, it scarcely seems probable that it has not been essayed. But admitting the process, as described, to be new, the claim appears to us much too broad, as it includes a naked principle, independently of any mode of carrying it into effect, a thing not patentable; the patentees cannot forestall invention, and deprive another of the reward of his talents, who may contrive a better mode of procedure than theirs. Should any one succeed in doing this, will his process make a part of their invention?

10. For improvements in the *Air Pump*; Timothy Claxton city of Boston, Massachusetts, June 7.

The patentee of this improved air pump is a manufacturer of philosophical apparatus in Boston, and on a visit to that city, about three months since, we had an opportunity of inspecting his establishment, and of examining many of the instruments made by him. It has been his aim to simplify the various articles which he makes, in order to supply the demand from academies and lyceums, at a price within the means of such institutions; and we were both gratified and instructed by the singular skill with which he has accomplished this purpose, without any sacrifice of utility. In several instances, we should have given the preference to the simple instruments of his make, as better calculated for the business of instruction than the more complex and costly ones usually employed, and described in the books. We have learnt from the public papers, that since our visit, the manufactory

of Mr. Claxton, with his tools and apparatus, have been consumed by fire, and although we have no further acquaintance with this gentleman than that which resulted from a casual visit to his workshop, we have sincerely regretted the event, not only on account of the individual, but also as a real loss to science.

The improved air pump for which the patent before us is obtained is single barreled. The pump plate is elevated above the table, upon four pillars, as is frequently done with double barreled pumps; the barrel is placed directly under the centre of the plate, and is, in general, made to work up and down upon the piston, the latter being stationary. The piston rod descends from the centre of the pump plate, and is perforated through its length; the barrel is fitted between two vertical guides, and a lever, working up and down like a pump handle, has its fulcrum sustained by two of the pillars; this lever has an opening to allow it to pass on each side of the barrel, to which it is connected by joints; it is made of cast iron, is japanned, and very neat in its appearance. The barrel is closed at bottom, and open at top; as it descends, the air from the receiver passes into it, and as it ascends, it is forced out through a second vertical opening in the piston, each of the openings being furnished with a valve.

There are some minor arrangements described, which we do not think it requisite to notice. The claims are to "The combination of a lever, connecting rods, piston, or barrel, with suitable guides, valves, ground plate, &c., together, so as to constitute a 'single barrel tube air pump,' whose operation is such that the act of exhausting the receiver presses the pump down on the table, or stand, upon which it is placed. A piston to be used with the movable barrel, in which piston there are two passages for the air; one for it to pass into, and the other from, the barrel, and two valves to close the passages alternately. The application of a gauge to operate by the expansion of air, so as to indicate the degree of exhaustion in the receiver, at any period of the operation. A method of fastening an air pump to the table, as above described, &c."

The kind of gauge claimed is not new, and the method of fastening the pump to the table might, we think, as well have been passed without a claim. The whole apparatus, however, accomplishes the intended purpose—namely, it acts well, and is offered at a very moderate price.

11. For an instrument for *Supplying and Diffusing the Colour used in Block Printing*; James Rennie, Lodi, Bergen county, New Jersey, June 9.

The specification of this patent is drawn up in legal style, which is all very well, excepting, as in the present instance, when that style is so involved and general, as to be unsuited to the description of a mechanical invention. For example, the machine is said to be for the "supplying or steeping with the ink, colouring matter, mordant, or other liquid or fluid desired or required to be stamped, printed or impressed, or for diffusing or distributing the same, over, under, or throughout, the cloth, felt, sponge, or other article, material, or im-

plement, designed or used for communicating such fluid or liquid to a type, form, or block with which it is intended or required or desired to make stamp print or impression which said cloth felt sponge or other article material or implement is in some processes of printing sometimes known by the name of a sieve."

What is called a description of the instrument is then given, which, by the anticipated consent of all our readers, we will omit, and endeavour, as well as the description and drawing will enable us, to give it in our own brief way.

A wooden trough, rather more than twice the size of the block to be used, is made to contain the colouring matter; a second trough of tin, copper, or other metal, occupies one-half of that first named, the centre of its bottom having a hole through it of one-fourth of an inch diameter. The colouring matter is poured into that space in the wooden trough not occupied by the metal one, and flows thence through a hole in a partition dividing the large trough into two parts, so as to pass under the metal, and up through the perforation in its centre. A sheet of sponge, or similar material, is to be placed upon, and to cover the bottom of the metallic trough, and upon this the sieve, used in such printing, may be placed. The height of the liquid poured into the first trough, with the degree of its fluidity, &c., will determine the rapidity with which it will be supplied to the sieve, and this, therefore, is capable of being properly regulated.

There is no distinct claim made, nor any attempt at distinguishing what is new, from that which is old.

12. For improved *Saddle Bags*; Joseph H. Latouraudais, Flint Hill, Rappahannock county, Virginia, June 14.

These saddle bags are intended principally to contain the bottles, boxes and instruments, used by physicians; two flat leather boxes, with suitable lids, are to be connected together by a strap, which is to pass over the back of the horse. The boxes are to be divided into compartments, by proper partitions, and the claim is to "the cases as above described."

13. For an improvement on the *Steam Engine*; Sprague Barber, Providence, Rhode Island, June 14.

The intention of this engine must be judged of by the account of its advantages as stated, and the claim made, by the patentee—the whole of the specification, with the exception of these, consisting of references to the drawings.

"The advantages resulting from this improvement are, First, the position of the cut off valves so near the leading valves, admits the steam at each operation, the steam to pass into the cylinder at the same pressure that it is in the boiler, and immediately, upon the opening of the leading valves. Second, as the cut off valves open before the engine comes upon its centres, the steam accumulates upon the leading valves before they are opened, so that as soon as they are opened, the steam passes into the cylinder with a pressure

equal to the pressure of the steam in the boiler, and this upon its first admission into the cylinder. A regulator on an engine would not effect the improvement, as that operates only on the last part of the steam passing into the cylinder. Third, an engine with this improvement will perform the same work with a far less quantity of fuel than an ordinary engine."

"What I claim as my invention, and for which I ask an exclusive benefit, is the compound eccentric on the main shaft, formed by adding another eccentric to the main eccentric in common use, by means of which two different motions can be produced; the form of connexion between the said two eccentrics, as afore described, by which the motion produced by one may be made to precede the motion of the other, as circumstances may require; and the insertion of a cut off valve in each of the valve chests, just before each of the leading valves of the common engine, thereby compounding the motion of the cut off and leading valves, and regulating the quantity of steam that passes into the cylinder."

14. For an improvement in the *Making of Glass or Sand Paper*; Isaac Fisher, jr., Springfield, Windsor county, Vermont, June 14.

The machinery described is for the purpose of sizing and distributing the glass upon the paper; the main things claimed are the steaming the paper on the unsized side, which prevents its curling; and the manner of distributing the glass upon the sized surface, which is done by laying the paper upon an endless feeding apron, and passing it under a sieve constructed for the purpose, which sieve vibrates in a close box over the paper.

15. For *Softening Glass Paper*, after the grains have been applied thereto; Isaac Fisher, jr., Springfield, Windsor county, Vermont, June 14.

In the machine by which the softening is to be effected, the paper is made to pass between steel rollers, of which there are five; three of them stand horizontally, and in the same plane, and two others beneath them, with their gudgeons intermediate between the upper rollers. The glass paper is laid upon a cloth, which passes between the upper and the lower rollers, and traverses once backward and forward, which completes the process. The machine is ingeniously contrived, and well represented.

16. For an improvement in making *Glass or Sand Paper*; Isaac Fisher, jr., Springfield, Windsor county, Vermont, June 14.

The improvement here made consists in taking quartz rock, and grinding and bolting it in any convenient manner, without first calcining it, and using the same as a substitute for pulverized glass, or natural sand, in the manufacture of paper; a better article being thereby

produced, from the greater hardness of the material, and the consequent durability of the angles.

17. For an improvement in *Making Glass, or Sand, Papers*; Isaac Fisher, Jun., Springfield, Windsor county, Vermont, June 14.

This patent is taken for an apparatus used for sizing the paper after it has received the glass, or sand. A wooden roller, covered with felt, is to revolve over a pan containing heated size, its lower side wadding therein; the superfluous quantity which it thus receives is pressed out by a metallic roller, as the felt rises from it. The paper, placed upon a sizing board, is then passed between another metallic, and the felted roller, the grained side of the paper being placed in contact with the felt.

We have given but a very general description of the several machines for which the foregoing patents have been obtained, more not being required. There are claims made to each of the contrivances, but we do not think the specifications in this part, sufficiently explicit. Respecting the machine last described, it is said that "The said Fisher does not claim the invention of the above pans, or the manner of setting the same, or the separate parts of said machine, but claims the invention of the manner of applying the same to the purpose of making glass, or sand, paper," which, it seems to us, is not claiming the machine in any form; and it has been decided that the mere application of an old machine to a new purpose, will not sustain a patent.

There is a strong resemblance between this machine, and those used for sizing in the manufacture of wadding, but still we think them sufficiently distinct from each other, in the arrangement of the parts, to admit of pointing out the alterations by which the former is adapted to the purpose of sizing sand, or glass, paper.

18. For an improvement in the *Power Loom*; James C. Kempton, Manayunk, Philadelphia county, Pennsylvania, June 14.

In the weaving of stripes in the ordinary power loom, the width of each stripe is governed by the number of the throws of the shuttle, and in case of the breaking or running out of the weft, the shuttle still goes on, and is replaced by another when it has counted its number, rendering the stripe, in such case, narrower than it ought to be. The object of the present invention is to remedy this defect, by causing the change of shuttle to be independent of the number of throws, and governing it by the actual width of the stripe. The arrangement by which this effect is produced, is not given so much in detail as it ought to have been, for want of a more complete drawing; but the general principle is distinctly set forth. On the end of the cloth beam there is what is called a pattern wheel, which revolves with the beam, and has on it cams, which are made to act upon the levers which raise the shuttles; and as these cams operate only by the turning of the pattern wheel, the shuttles cannot be changed until a cer-

tain width of cloth is wound thereon; the same shuttle, therefore, may be thrown any number of times, if empty, as the beam will not move. The claim is, to "the method described of changing the boxes, independent of the number of throws of the shuttle, by means of the stripe actually woven."

19. For improvements in *Locomotive Engines, Cars, and Carriages*, used upon Rail-roads; Alfred C. Jones, city of Philadelphia, June 14.

The improvements claimed under this patent are three in number. The first consists in the application of what is called a false flanch, to obviate the difficulty resulting from the rapid wear of the tire, where the tread and flanch come in contact with the rail. When this has taken place, the wheel is to be turned in a lathe, to adapt it to the receiving of the false flanch, which is to be riveted on, in a manner shown in the drawings.

The second relates to the apparatus for supplying water from the cistern of the tender, to the boiler. This consists in the substitution of metallic tubes for the hose commonly used, which tubes have ball and socket joints, or others, admitting of a ready motion in all directions. The patentee says, "I do not in this part claim to be the inventor of flexible metallic tubes, such as I have described; but what I do claim is their adaptation to, and employment in, locomotive carriages and tenders, for the purpose of supplying the engines with water."

The third improvement is in the oil cup, or syphon, which is used for oiling the machinery, and consists in the manner of confining the lid thereof by means of a spring, instead of by sliding, or screwing, as is most commonly done. The mode of applying the spring is represented in the drawing, and its application is claimed.

20. For a *Machine for Drawing in Perspective*; Richard Lyons, New Rumley, Harrison county, Ohio, June 14.

This machine operates by means of a Pentagraph, in a manner well known. The Pentagraph is to be placed vertically, and one end of it is to be used to sight the object, whilst the other, furnished with a pencil, draws it upon paper. For this purpose, there is to be a vertical frame, one portion of which may contain a pane of glass, and the other a pannel to receive the paper. That end of the pentagraph which is used to sight the object, moves on, or near to, the pane of glass, the sight being the head, or end, of a projecting pin. At a suitable distance from this, there is an eye-piece furnished with a small hole, and looking through this, the pin is to be made to pass over the outline of the object to be drawn. The claim is, to "the application of the Pentagraph to produce the drawing on the paper, or other material, below, or beside, the perspective frame."

A machine perfectly similar in principle was patented by I. Todd, A. Day, and W. Bache, on the 15th of June, 1803, excepting that it was intended for taking profiles only it was applicable, however, to

the drawing in perspective, and was repeatedly so applied. In one particular it was very superior to the machine above described, as, instead of the pin, the end of which is to be passed over the lines of the object, a dark point was made upon a piece of glass; the pin had been previously tried, but was rejected, the glass being incomparably better. In taking profiles, the sighting was made through a tube, with which the object was followed by the eye; but when used for drawing in perspective, the tube was removed, and a fixed eye piece employed. The object was traced *above*, and not "below or beside the perspective frame;" this, however, we suppose the patentee will confess is altogether immaterial; and if not, by ascending to a more remote antiquity, we can show a machine in which the copy was made *beside* the frame.

In the eighth volume of the Transactions of the Royal Society, under date of July 21st, 1673—that is, 160 years ago—an instrument exactly the same in principle with the foregoing, is described, under the title of "*Modus novus delineandi per radios parallellos ad aequalitatem orthographicam, gestus, situs, habitusque quoscunque humani corporis, servata symmetria, proportione que partium.*"

Accompanying the description of the machine employed, there are two engravings, one of which represents it as used for drawing outlines, in the manner of Todd, Day & Bache's machine, and the other with a fixed sight for drawing in perspective, the delineation being made "beside the perspective frame."

We do not suppose that the patentee has been a plagiarist, and stolen the idea from our forefathers, or even from our contemporaries; but one thing is manifest—namely, that his new invention is very old, and that, like many hundreds of his compeers, he cannot sustain his claim.

21. For *Machinery to supersede the use of Steam in Propelling, &c.*; Louis Marchand, city of Baltimore, June 14.

This, we are told, is called a "safety engine," which name it receives, undoubtedly, because it is not liable to explode; and provided the confidence of more than one man is necessary to the explosion of a project, we may unhesitatingly aver that it will not explode even in the metaphorical acceptance of the term. A boat is to be propelled, or certain machinery moved, by the power of "one or more men, according to the size of the handle of the *swipe*," which *swipe* is a piece added to the end of a lever, and said lever is to be worked up and down like a pump handle—the *swipe*, or addendum, in some way, which does not, and never will, appear, most marvellously enabling the power applied to produce an effect at least a hundred fold.

22. For *Springs for Rail-road Cars*; Ross Winans, Civil Engineer, city of Baltimore, June 14.

(See specification.)

23. For a *Plough*; Shem Zook, Armagh, Mifflin county, Pennsylvania, June 14.

The description of this plough is by no means elaborate, and what might have proved a difficult task, the specification of its peculiarities, has been thereby avoided. The land side, we are told, is to be pretty much like that of Carrothers', and the mould board is to resemble Spielman & Miller's. "The parts on which no improvement is claimed are a beam and shafts of wood, and of the common kind and common coulter; also, a sole attached to the hind part of the mould board, which can be regulated at pleasure." We suppose that the word *no* means *an*, but so ends the specification.

24. For a *Method of Grinding and Polishing Marble, and other Stones*; Samuel Risley, city of Philadelphia, administrator of Richard S. Risley, deceased; June 14.

A wheel of cast iron, grind stone grit, or other material, is to turn horizontally, like a lapidary's wheel; but it is to be made sufficiently large to grind such pieces of marble, &c., as may require it; any of the ordinary substances used in grinding are to be applied to the wheel. For polishing, one of wood, covered with cloth, may be employed.

"The improvement claimed consists in the method of grinding, smoothing, and polishing, marble or other stone, as above described, whereby a great saving of time is effected, and a true surface, and superior polish, is given to the marble or stone."

This patent is taken for a "method of grinding," and not for the machine, or apparatus, by which it is effected. A method, according to our view of the subject, is not one of those things included in the patentable subjects enumerated in the patent law. Where an operation, such as grinding or polishing, is performed by means of a machine, if the machine is not new, there is nothing to patent.

25. For an improvement in the *Forge Hammer Arm*; James Sharp, Spruce Creek, Huntingdon county, Pennsylvania, June 14.

This patent is taken for a *tappit arm*, or lifter, which is to be fixed into a cylinder, to raise the handle of the tilt hammer. This tappit arm is to be in part of cast iron, and in part of wood, and it is claimed "as described," which description is not such as to enable us to perceive what are the advantages anticipated from its use, nor indeed fully to understand its construction.

26. For an improvement in the *Constructing or Building of Canal Boats*; John M'Causland, Kingston, Ulster county, New York, June 14.

That boat builders may judge of the novelties introduced into the construction of this boat, we will give an abstract of the specification, there being no claim.

The bilge, from stem to stern, is to be of solid, square stuff, the size depending, of course, on that of the boat. The floors are to be

joined to these timbers by dovetails, or mortises. The bilge timbers are to be rebated, to receive the plank on the sides and bottom, which are to be fastened by bolts. The keelson and keel are to intersect in the bilge timbers, fore and aft the boat. Plank, shears, &c. &c., to be used, as necessary.

27. For an *Elastic Water Dress*; Leonard Norcross, Oxford, Dixfield county, Maine, June 14.

A dress is to be made of India rubber cloth, or any similar material, with a suitable cap for the head, furnished with strong glass to see through. There are to be tubes for the supply and discharge of air, &c. &c. This patent is taken by one not acquainted with what has been heretofore done, or indeed with what can be effected by such means, as there is no novelty in the plan, and the anticipations of what can be accomplished by it are entirely illusive. We are told, for example, that "a man in this dress can descend to a great depth, and remain there for six hours, or more; enter the cabin or hold of vessels which are sunk; walk about upon the bottom; place rock for the abutments of bridges," &c. &c.

Experience, we have heard, has since convinced the patentee that he had "reckoned without his host," and has taught him something of the powers of nature in this business; we are informed, also, that he has been thereby led to make a real improvement in the management of the apparatus.

28. For an improvement in the *Cotton Gin*; Jacob Perkins, Bridgewater, Plymouth county, Massachusetts, June 14.

This patent is obtained for a mode of adapting a movable seed board to the cotton gin, so that it may be readily adjusted in any required direction, and the claim made is to the particular mode of adjustment.

29. For a *Guard to prevent Water from beating under doors*; Daniel Bulkeley, Hampton, Windham county, Connecticut, June 14.

The specification of this patent is very brief, informing us, merely, that the door guard consists of a trough, or channel, which is fixed at the lower end of the door, extending across its whole width; which trough may be made of wood or metal, and is to receive the water as it trickles down the door; it is also to be continued across the threshold, so as to carry the water off to the ground.

30. For a *Machine for Cutting and Cradling Wheat*; Bernard Jackson, Brown county, Ohio, June 14.

The description of this machine is not very clearly written, but the drawing being well executed, its construction may be collected from the two together, although, without the latter, we can give but a general idea of it.

The machine is to run upon four wheels, two of which are coupled

on that end of it to which the horse is attached, and the other two at the hind, or operating, end. These latter wheels are made rough, to take hold of the ground, and have beveled teeth on them to gear into a bevil wheel upon vertical shafts; one of these vertical shafts carries four scythes, standing out at right angles from each other; above these scythes, there are fingers upon the same shaft to collect the grain. On the opposite vertical shaft, there are what are called discharging arms, which are to deposit the grain, as it is cut, behind the left side of the machine. The claim is to this combination of machinery for cutting grain.

However good this apparatus may prove in certain situations, like other mowing machines, it can be used only upon such land, the surface of which is uniform, and clear from stones and stumps.

31. For a *Machine for Sawing Wood for Fuel*; Harlow Mitchell, Rutland, Jefferson county, New York, June 14.

This machine, as described, is to be attached to a common saw mill, so as to work a cross cutting saw by the ordinary power of the mill, and to use the ordinary carriage for moving the log, so as to bring it crosswise against the saw. The saw, and indeed the whole apparatus, is so made that it may be attached and removed at pleasure. The patentee proposes to use it in all cases where logs are to be cut transversely, into bolts or short blocks, for any purpose, and avers that, in his first experiment with it, he sawed to the amount of twenty-four cords of wood, from large logs, in twelve hours. The saw which he uses is to be fixed in a rectangular frame, working upon pins, forming joints at each of the corners. One of the vertical timbers of this frame is attached to the frame of the saw gate, there being another parallel to it, from ten to fifteen feet in front of it. The saw is to be hung to two of the horizontal pieces of timber that connect these vertical pieces, one of which will vibrate above, and the other below, the log to be sawed. The saw, like the ends of the frame, must work upon joint pins, and may be three or four feet in advance of the ordinary mill saw. There is a jack, or clamp, the construction of which is shown in the drawing, to hold the log to be cross-cut; this jack is attached to the ordinary carriage, so that, when the water is let on, the log will be carried against the saw. There are several particulars in the action of this machine, which should have been more fully set forth in the specification; and this certainly might have been done, as the inventor professes to have carried the plan into practical operation.

The patentee "claims as his own invention, the application of water, steam, or horse power, to sawing wood transversely; the particular manner of placing a lateral and transverse carriage, with all such variations in the mode of securing them to each other, as the peculiar formation of the mill may require; the peculiar manner of securing the log between the standing and movable posts, but brought together by a jack; with all such modes of securing and making the joints, as the peculiar situation of the place, and presence of materials, may make most convenient."

We think this claim is too broad, especially in the first member of it, as wood has been frequently sawed transversely by water, steam, or horse power; and if this had not been done, the mere doing so will not justify a claim to all the methods of accomplishing it which may hereafter be invented.

32. For the *Frame-work of Mills*; William S. Parham, Sussex county, Virginia, June 14.

The specification of this patent consists of a number of particular directions respecting the manner of forming and keying the joints, in framing the upper story of a mill; and also the manner of placing the braces, and flooring joists, and of supporting the latter from the roof above them. We are unable, however, to deduce therefrom any thing new in principle, or superior in practice, to what is already known. The patentee says, "My claim is to the manner in which the frame work of the upper story is put together and secured, as above described, and particularly the manner in which the king-posts support the joists at the lower end of said posts; also the manner of securing the girders to the joists; and to the suspension posts as depending from the joists above, in order to support the weight of the gearing working from the power wheels."

33. For *Metal Combs*; Allen Porter, Hartford, Hartford county, Connecticut, June 14.

The back of the comb is to be made of a rod, or bar, of any kind of metal, which is to be drilled, so as to receive the teeth; when these have been inserted, the bar is to be compressed, so as to keep them firmly in their places; or, the holes being sufficiently small, the teeth are to be driven in so as to be firmly fixed.

"The improvement claimed is in the fastening the teeth, without soldering or riveting, by putting them into the back, so as to have the back smooth, without having the teeth come through the back of the comb."

34. For an improvement in *Windlasses for Vessels*; Leonidas V. Badger, and Richard Walker, Portsmouth, Rockingham county, New Hampshire, June 17.

The improvement consists in the application of double palls to a ratchet wheel, or a ship's windlass. A horizontal lever is hung on its centre, above the windlass, and two palls, one from each side of the centre pin, fall into the teeth on the same side of a ratchet wheel, fixed upon the windlass; and, consequently, whichever end of the lever is depressed, the ratchet wheel will be forced round. The claim is to "the application of the above form and power to ship's windlasses, for raising anchors, &c."

We do not know that a ratchet wheel and palls, exactly in the form specified, have been applied to the windlasses of ships; but there is nothing new in the arrangement of the lever, palls, and ratchet

wheel, the same being a well known application to machinery of various kinds.

35. For a *Machine for cutting Hay and Straw*; Barnabus Davee, Leeds, Kennebec county, Maine, June 17.

There are to be two feeding rollers, one placed above the other, the lower of which rollers is to be turned by a crank, and the upper one borne down upon it by springs. A cog wheel of twenty-four inches diameter is to be placed in the axis of the lower roller, and this to drive a pinion of five inches in diameter, in front of it. The shaft on which this pinion is fixed lies parallel to, and in front of, the rollers, and carries the knife by which the cutting is to be effected, this knife being attached by its ends to arms, standing out at right angles from each end of the shaft; the arms must be of sufficient length to cause the blade to reach the point where the straw, &c. is delivered from the rollers. We suppose that there must be a bar, or rest, of iron, for the knife to cut against, but of this nothing is said. The knife, it is observed, may, if desired, be placed obliquely; but there is not any thing said in the nature of a claim.

36. For improvements in the *Power Loom*; Aden Holbrook, and Benjamin F. French, Dunstable, Hillsborough county, New Hampshire, June 17.

The specification of this patent refers throughout to the accompanying drawings, which are very perfect, and are necessary to a complete understanding of the things claimed. The improvements made are three in number; the first "is a stop motion, by means of which the loom is stopped of itself, whenever the filling, from any cause, is not thrown into the warp." "Whenever the threads of the warp adhere closely together back of the lease rods, the rods are drawn out of their place towards the harness, by which means defects are produced in the cloth, called draws. In order to give notice to the weaver before any injury arises from this cause, another stop motion has been invented by us, which is the second improvement upon the said loom claimed by us as our invention." "A let off motion, whereby equal quantities of warp, whenever cloth is made, are unrolled from the yarn beam in equal periods of time, is the third improvement upon the said loom which is claimed by us as our invention. By means of it, cloth of an uniform thickness can be made; it is described as follows," &c.

We have thus indicated, in the words of the patentees, the object of their improvements, which is all that we can now do.

37. For a *Churn*; John Broom, Hallowell, Kennebec county, Maine, June 18.

A band wheel turned by a handle, is to give motion to a whirl on a crank shaft, the crank serving to move the dasher of a common churn, which is fixed immediately below it. This constitutes the whole of the *new and useful* invention before us, to which, however, is

appended a claim to "the particular form and arrangement of the machinery by which the dasher is moved, and the application of the several parts of the machinery to effect the purpose specified."

38. For a *Water Wheel*; Henry Averill, Richland, Oswego county, New York, June 18.

This is an undershot wheel, to be used in streams where there is but little head and fall. Particular admeasurements are given in the specification, but these we need not notice. The buckets, or floats, are hinged upon the arms, or rims, of the wheel, the hinge being at the lower edge of the bucket as it enters the water; the buckets, therefore, stand in the usual position, bearing against the radiating arms whilst they are entering, and are subjected to the force of, the water; but as they begin to rise from it, their hinges admit of their taking a direction which will enable them to leave without lifting it, hanging off from the arms until carried up to the top of the wheel, when, by their own gravity, they fall against them, and are so sustained until they again leave the water. The patentee avers that, after the experience of a year in the use of such a wheel, he is convinced that much power is gained, which, in the ordinary construction, is wasted by the lifting of the bucket, particularly where there is back water. There is no claim made, but the particular object of the invention is sufficiently distinct, and it differs essentially from the hinged buckets which have been so frequently essayed in running streams; we think also that it offers some advantage from the cause stated by the patentee, whilst there is little, or no, objection to the hinges on the score of complexity.

39. For a *Thrashing Machine*; John Melvin, Readfield, Kennebec county, Maine, June 18.

40. For an improvement in the *Machine for Spinning Wool*; Asa Campbell, Kingston, Luzerne county, Pennsylvania, June 19.

This is a very complicated affair, produced by the addition of a number of whirls and bands, and other appendages, to the common wheel for spinning wool; the whole object of which additions appears to be the enabling of the spinster to keep her seat, instead of running out and in with the yarn. The wheel is constructed and turned as usual, but the spindle is attached to the end of a pendulum, which is to be thrown out by placing the foot upon a treadle, and to be drawn back by a weight when the foot is removed. The claim is, to "the principle of throwing the spindle out with the foot upon the treadle, by means of the spindle being attached to a pendulum, to which is connected the different cords, and weight, calculated to bring the spindle back to the person using the machine, thereby making it conveniently worked by the person in a sitting posture."

To accomplish this object, it appears that forty or fifty feet of band

are to be employed, running over the wheel, and five whirls, or pulleys. The old fashioned wheel, for spinning one thread at a time, has nearly received its death-blow from the improvements in machinery; and were a law to be passed, compelling the substitution for it of the above patented improvement, we really think that such a law would effectually give it the *coup de grace*.

41. For a *Pneumatic Breast Pump*; James P. Stabler, Sandy Spring, Montgomery county, Maryland, June 19.

A glass vessel, having two openings into it, is, in order to its producing the intended effect, to be exhausted of its air by the action of the mouth. One of the openings is to be applied to the breast in the usual manner, and the other is to have a cap cemented on to it, to receive the end of a flexible tube, the outer end of which is to be applied to the mouth. A valve is contained within the juncture of the flexible tube with the cap of the glass vessel, which valve, of course, opens upwards; the construction of it is particularly explained, but is spoken of as susceptible of variations. Through the cap there is a small opening, which is to be covered by the finger whilst the instrument is in use, the withdrawal of the finger allowing it to be removed readily from the breast.

"The improvements claimed are, the application of a valve to the pneumatic breast pump, in which the vacuum is formed by the mouth of the operator; and the perforation of the cap, or vessel, by which means the external air may be admitted to diminish the drawing power of the instrument, when painful to the patient, and by which the operation may be immediately suspended, without inconvenience."

42. For a *Cooking Stove*; Philo P. Stewart, Elyria, Lorain county, Ohio, June 19.

There is not any thing very peculiar in the construction of this stove, the claim being made to certain modes of arrangement, some of which may have their particular advantages. Those who can appreciate the luxury of a hot dinner, upon warmed plates, will approve of a "warming arch" constructed under the oven, whether the same be new or old.

43. For a mode of *Increasing the adhesion of the Driving Wheels in the Locomotive Steam Engine*; Ezra L. Miller, city of Charleston, South Carolina, June 19.

(See specification.)

44. For an improvement in the *Manufacture of Vinegar*; Edward Clark, Saugerties, Ulster county, New York, June 19.

(See specification.)

45. For a *Self-acting Clock Alarm*; Otis N. Angell, Johnston, Providence county, Rhode Island, June 20.

A good general idea of the manner of setting this alarm in motion, will be obtained by the following short quotation from the specification.

"This machine, so constructed, is affixed to the inside of a common clock case, just below where the striking weight is found by experiment to come at a given hour. The weight on the barrel is then wound up in the same manner that the ordinary weights of a common clock are. When the hour has arrived at which it is wished that an alarm should be given, the striking weight of the clock, in the striking of the hour, descends, and brings up against the perpendicular slide, and forces that down, together with the end of the lever in which it is placed. The other end of the lever is, of course, raised up above the teeth of the ratchet wheel into which it plays. By an additional lever, to be acted upon by the running weight of the clock, an alarm may be sounded at any intermediate time between the hours."

46. For a *Reaping Machine*; Cyrus H. M'Cormick, Rockbridge county, Virginia, June 21.

The main operating part of this machine is old, as will be seen on referring to our remarks on the patents of T. Manning, vol. viii., p. 195, and of O. Hussey, vol. xiv., p. 37, and indeed there are other points in it liable to the same objection; but when the major proposition is proved, the minor one may be left untouched. The following is a part of the claim:

"My claim is to the arrangement of the several parts so as to constitute the above described machine. And I particularly claim the cutting by means of a vibrating blade, operated by a crank, having the edge either smooth, or with teeth, either with stationary wires, or pieces, above and below, and projecting before it, for the purpose of staying or supporting the grain whilst cutting; or the using a double crank, and another blade or vibratory bar, as before described, having projections before the blade, or cutter, on the upper side; both working in contrary directions, thereby lessening the friction, and liability to wear, by dividing the motion necessary to one, between the two."

47. For an improvement in *Steam Boilers*; Benjamin Phillips, city of Philadelphia, June 21.

This improvement is said to consist in "a mode of determining or defining the water line, or height of water, in steam boilers." The method proposed is to connect a vertical tube to one end of the boiler, by means of two lateral tubes, one opening into the water, and the other into the steam chamber, in the manner of the glass gauges sometimes used for that purpose, especially in France. The lateral tubes are to be furnished with valves, and the vertical tube is to have a cap, which may be removed at pleasure. To use this appendage, the cap is to be closed, and the two valves in the lateral tubes are to be first opened, and then closed, which will allow the water in them to stand on a level with that in the boiler. The cap on the

vertical tube is then to be removed, in order to gauge the height of the water within it.

We do not believe that when the water is agitated by the motion of a vessel, and by the supply of steam to the engine, that accurate results can be thus obtained, although they might when every thing is at rest. But even admitting that the instrument would act correctly, it would never come into use for ordinary observations. Something is required for this purpose, the indications from which would be forced upon the engineer, or, at all events, which he could observe with scarcely any trouble, or the thing will be neglected.

48. For a *Washing Machine*; Jotham Chase, Waterboro', York county, Maine, June 23.

There is to be a rectangular box, three feet long, eighteen inches wide, and fourteen deep, the inside of which is to be lined entirely with fluted boards, and there are to be doors on one side to admit the clothes to be washed. The box is to be suspended on gudgeons, like a revolving churn, and upon one of the gudgeons there is to be a cog wheel, whilst another wheel, one-half its size, and fixed upon the frame, meshes into it. On turning this smaller wheel by means of a handle, the box will revolve, and the clothes falling from end to end of it, will, it is said, be washed clean in a very short space of time. If so, however, there are other washing machines, already in use, which are so much like it, that we see no reason why they should not operate at least equally well.

49. For machinery for *Napping and Steaming Woollen and other Goods*; Stephen R. Parkhurst, Providence, Bristol county, Rhode Island, June 24.

This machine has cylinders, so arranged in and above a copper kettle, containing water heated by a furnace, that on turning the respective cylinders by proper gearing, the cloth, attached to aprons on two of the cylinders, may be passed backward and forward, in a state of tension, through the heated water, one roller within the kettle, depressing it for that purpose, whilst napping cylinders, furnished with teasles, or cards, operate upon the cloth.

There are several things claimed, of which the following is an abstract. The tightening of the cloth, so as to preserve a uniform strain, by the arrangement of the cylinders. The arrangement for passing the cloth into the heated water, and presenting it to the napping rollers, thereby securing all the advantages of the steaming process. The rendering the cloth, by this process, glossy, and free from wrinkles. The method of drawing the nappers either on or off the cloth, and the rack and pinions for raising the small frame out of the kettle.

50. For a *Horse Power*; William Burk, Whitemarsh, Montgomery county, Pennsylvania, June 25.

This horse power is the common movable floor, revolving round

two drums, with so little variation from those in common use, that we do not know, and the patentee does not tell us, in what the invention consists. We are informed, however, that it will be a very good thing with which to propel canal boats, and the patentee says, "As I am the original inventor of the application of this horse power to the use of propelling canal or other boats, (which will be of great importance to the public generally,) I claim the privilege of having that part of the application secured to me in the letters patent, with the privilege of regulating the gearing."

We have yet to learn what is intended by the invention of an application of a machine. If a man invents a wheelbarrow, for the purpose of wheeling potatoes about, it does not seem quite reasonable that another shall sustain a patent for the application of it to the wheeling of apples; yet from the tenor of a number of specifications, it would appear that there are many who think this may be done. Whether the application of this horse power has been made to the propelling of canal boats, is a question which we cannot determine; but to "other boats," as, for example, to ferry boats, it has been frequently so applied. We mention this as a mere fact, and not because it affects the validity of the claim above noticed.

51. For *Lever Valves for exhausting Air and Water*; Hiram Strait, East Nassau, Rensselaer county, New York, June 25.

We are informed that the improvement here patented consists in the "application and operation of valves, on the principle of a balance, for the purpose of percussing, compressing, and exhausting, air and water;" and this information is followed by an intended exemplification of the different modes in which this principle of a balance valve is to be applied. The whole affair, however, is a "fancy's sketch," which never will, because it never can, be brought into practical operation, so as to produce any useful effect, in either of its forms. The principle alluded to is the placing a rod or shaft so as to turn, or rather vibrate, on gudgeons, and attaching to it two somethings, that the patentee calls valves, which are opposite to, and balance, each other. In the plan first described, which is to operate upon air, the valves on each side of the rod are to consist of narrow, parallel curtains, standing somewhat in the manner of the slats of blinds, which are alternately to open and close by vibrating the apparatus; and this is to be applied "to the theory and practice of aerial, marine, and submarine navigation: to the propulsion of cars on railroads, boats, windmills, and ventilation;" how, we do not learn, and never shall. With this item of the information communicated, we dismiss the subject, lest we should not do it adequate justice.

52. For improved *Medicated Liquid Magnesia*; Richard Jordan, and Matthew Anderson, city of Philadelphia, June 25.

Mr. John Cullen, then of the city of Philadelphia, obtained a patent about sixteen years since, for liquid magnesia, which was formed by rendering magnesia soluble by its combination with carbonic acid,

in the ordinary mineral water apparatus. To make the beverage palatable, sugar and rose water were put into the fountain with the magnesia. The mixture, as employed by the present patentees, consists of 12 gallons of water, 2 lbs. carbonate of magnesia, 8 lbs. loaf sugar, half a pound of Rochelle, or other purgative salts, 12 grains sulphate of quinine, 4 ounces iron wire, 1 lb. compound aromatic tincture. The quinine is to be dissolved in the aromatic tincture, and the whole put into a fountain, and carbonic acid forced in until the magnesia is dissolved. The patentees say that these alterations are made with a view to the rendering of the compound more purgative, and at the same time giving to it a tonic property. As the process for dissolving magnesia is not new, they are of course limited to the kind of mixture which they have designated.

53. For an improvement in *Inclined Planes for Rail-Roads*; Levi Burnell, Elyria, Lorain county, Ohio, June 26.

"This improvement, for enabling locomotive engines to ascend inclined planes, with their full complement of wagons, without the intervention of stationary engines and their appendages, consists simply, 1st. In the use of an additional rail or rails placed parallel, and near to, but more elevated than, the track of the way to which the improvement is applied. 2d. In the application of a wheel, or wheels, with peripheries of smaller diameter, in connexion with each of the ordinary working or bearing wheels of the locomotive carriage."

Those who are acquainted with the proposed improvements on rail-roads, will perceive that the plan before us is but a new edition, without additions, of what has been before done. The often proposed formation of teeth upon the rail, and smaller wheels, to prevent slipping are also alluded to by the present patentee. In vol. 8 of this Journal, page 22, there will be found a specification of a patent "For locomotive carriages, and rail-roads adapted thereto," obtained by Emmor Kimber, in which all the above proposed improvements, with some others, are included. For some of them, we might go still further back.

54. For an improved *Saw Mill*; Asa Ransom, jr., Clarence, Erie county, New York, June 26.

A mill saw is to be hung in the ordinary way, but it is to have teeth on both its edges. The head blocks are to be so constructed as to admit the board to be sawed entirely off, leaving no stubshot. There must be two feed hands, and two rag wheels, to move the carriage in either direction. The specification is very brief, and does not describe the respective parts with any clearness, while the drawing is altogether inadequate to supply the deficiency. This, however, is of the less importance, as in a patent obtained by Mr. Joseph Newton, of Monroe county, New York, on the 1st of October, 1830, an account of which is given at p. 10, vol. vii., it will be seen that "the improvement proposed is to have teeth on both edges of the saw, and to construct the mill in such a manner that the log may be sawed in

passing either way. There are to be two feed hands, and two rag wheels, operating in reversed directions."

55. For a *Machine for Spreading Hay, &c.*; Joab Centre, city of Hudson, Columbia county, New York, June 27.

A frame, fixed upon wheels, is to be drawn by a horse; a shaft crossing this frame, and revolving upon gudgeons, is to have rods, or long teeth, projecting from it, so as to reach within an inch or two of the ground. A band from one of the wheels passes round a whirl upon the shaft, causing it to revolve rapidly as it is drawn along, and consequently to scatter the mowed grass which is to be made into hay.

There is no claim made.

56. For improvements in the *Machinery for Manufacturing Wood Screws*; Rufus C. and Clement O. Reed, Worcester, Worcester county, Massachusetts, June 28.

After describing this machine, by the aid of several drawings, representing its construction in detail, the patentees say, "Most of the operative parts of the machine, as within described, are such as are well known, and are used in other machines, but differently combined together; we do not therefore claim them, in their individual characters, as making any part of our invention; but what we do claim, is the placing the main shaft, which carries the screw, vertically, and giving to it a continuous motion, by the general arrangement of the parts described. We also claim the mode of feeding herein set forth, as adapted to the motion of the vertical shaft, and we do hereby declare that whilst we claim the general principle, or mode of action, of the vertical shaft and its appendages, we do not intend to confine ourselves to the exact mode of construction herein set forth, but to vary the same in any manner which we may deem proper, whilst the principle of action remains the same, and similar effects are produced."

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a Patent for a mode of increasing the adhesion of the driving wheels of the Locomotive Steam Engine. Granted to EZRA L. MILLER, Charleston, South Carolina, June 19th, 1834.

To all to whom these presents shall come, be it known, that I, EZRA L. Miller, of the city and district of Charleston, state of South Carolina, have invented a new and useful mode of increasing the adhesion of the driving wheels of the locomotive steam engine on railroads, by using the tender, or car, next the engine, for the purpose of adding weight to the driving wheels of the engine, at such times only as a greater adhesion is required than the weight would give, which it would be practicable to carry as a fixed weight on those wheels, without injury to the road.

At the points of starting, and on the ascents where increased adhesion is required, I attach part of the weight of the car, or tender, which is next the engine, to the end of the frame of the engine next the driving wheels, which may be done by means of a lever, screw, wedge, or pulley, and detach it again, when the increased adhesion is no longer necessary.

The mode which I have used, and found to answer perfectly in practice, is simply to connect the car, or tender, next the engine, to the engine, by a strong iron bar, or lever, one end of which is bolted to the under side of a cross timber in the frame of the car, or tender, a little back of the centre, and which lever extends under the frame of the tender, to the end of the frame of the engine, and into the iron which, together with the drawing bolt, secures it to the engine.

Transversely to this lever, I attach to the end of the tender next the engine, two levers, so that their fulcra shall be six or eight inches on each side of the main lever, or drawing bar.

These levers have a jaw, or pivot, five or six inches in length, directly over the main lever, and should be about $4\frac{1}{2}$ feet in length.

When the increased adhesion is wanted, the engineer has only to place his foot upon the ends of these levers, and press them into a hook, or groove, for that purpose, on the corner post of the tender; and a portion of the weight of the car, or tender, next the engine, is thus thrown upon the driving wheels of the tender; and when the increased adhesion is no longer wanted, this weight is detached by simply loosening the ends of the levers.

What I claim as my invention, is the making use of the car, or tender, next the engine, for the purpose of increasing the adhesion of the driving wheels of the locomotive steam engine, at those points where more adhesion is required than the weight would give, which it is eligible to carry as a fixed weight on those wheels, whether the same be effected in the mode above described, or any other which attains the same end.

E. L. MILLER.

Specification of a Patent for an improvement in the mode of manufacturing Vinegar. Granted to EDWARD CLARK, Saugerties, Ulster county, New York, June 19th, 1834.

To all to whom these presents shall come, be it known, that I, Edward Clark, of Saugerties, Ulster county, state of New York, have invented or discovered a new and useful improvement in the manufacture of vinegar, and that the following is an exact description of the same.

I prepare suitable vessels, casks, or cisterns, of a capacity to correspond with the quantity of liquor on which I wish to operate, and arrange them internally in a manner very similar to the casks made by M. Laucks, modified by M. Tier, for the manufacture of vinegar—an account of which may be found in many of our scientific periodical works. I then connect the upper part of these vessels, casks,

or cisterns, by means of pipes, to an air-pump, or any kind of blowing apparatus, in such manner as that, when the air-pump is put in operation, it shall draw a current of air through the vessels aforesaid, and deliver it through a refrigeratory apparatus for the purpose of condensing such portion of the liquor as the air may hold in solution, and thus preventing its loss.

Instead of this arrangement, I sometimes force a current of atmospheric air into these vessels, casks, or cisterns, near their bottoms, by means of an air-pump, or other blowing apparatus, from whence it passes to their top, in apparent contact with the liquor, and is from thence led off, by means of pipes, through a refrigeratory apparatus, in the same manner, and for the same purpose, as above set forth and described.

What I claim as my invention or discovery, and for which I ask letters patent, is the application of the blowing apparatus to these vessels, so as to induce, or create, a more rapid current of atmospheric air, through liquids being converted into vinegar, than would otherwise take place.

EDWARD CLARK.

TRANSLATIONS FROM FOREIGN JOURNALS.*

Methods of Tanning Skins and Hides, by using Liquor of Tar, and of Soot.

In compliance with requests which have been made to us, we offer to our readers two processes for tanning, by means of the liquors of tar, and of soot, varying a little in their form; the ingenious workman will be able to avail himself of whatever may be useful in the two methods.

PROCESS OF WILLAIREBERRES.

Preparation of the Tar Liquor.

Throw about eighteen or twenty pounds of good tar, into 100 gallons of boiling water, add a sufficiency of lime to form a thick paste, then pour cold water upon this composition, that the lime may be converted into powder; add again about a bucket of tar, and an equal quantity of powdered lime, and stir the whole well till you obtain once more a thick paste.

The whole composition is distributed into several vessels, or vats; boiling water is then poured into the vats, taking care to stir the composition with a shovel, three or four times, whilst pouring it in. As soon as the water is mixed in the vats, these vessels are covered, and, twenty hours afterwards, the liquor may be used.

Preparation of the Liquor from Soot.

Put into a boiler, for every hundred pounds of soot, sixty gallons of boiling water, and four pounds of lime in powder, taking care to

* Translated by request of the Committee on Publications.

stir the whole three or four times with a shovel, while filling the boiler; then cover the boiler, and, at the end of twenty-four hours, you may make use of the liquor it contains, after having filtered it in a bucking tub pierced with small holes, and filled with fine sand; the clearer this liquor is, the better.

Preparation of Skins intended for prepared, or glossy, Leather.

The skins thus prepared are put into cold vats of gallic acid, and boiled bark of oak, in which they remain four or five days, and even a week; after which, they are taken out, and steeped in the vats three or four times daily; they are then put in warm liquor of tar, diluted with an equal quantity of water, and the strength of this liquor is gradually augmented till it reaches its first state. The skins, after remaining fifteen days in the liquor, are put again in the vats of gallic acid, and boiled bark of oak, as at first—then in weak tar liquor; they are then withdrawn, and steeped in the vats three or four times daily, during the first fortnight; they are then shifted into bucking tubs, containing liquor of its full strength; they are taken out, and again steeped two or three times daily, until they are well soaked in the liquor.

The skins, having reached this state, are put into a vat of warm water during half an hour; they are afterwards taken up, and placed upon a table of marble, resembling those used by curriers to thin their skins, upon which they are brushed, washed, and cleaned, on the flesh and grain sides, three or four times a day, during the last week that the skins remain in the liquor. This operation being ended, the skins are put, during a week or more, according to their thickness, and the use they are intended for, into a vat of warm liquor of bark, or sumac liquor, and, when taken out of this vat, they are dried in the usual manner.

Preparation of Hides for Sole Leather.

Hides intended to make sole leather, must, like the preceding, be haired, fleshed, and worked, as usual, upon the marble table; they are then put, for several days, into a cold vat of gallic acid, and of boiled oak bark; after this preparation, they are taken out and steeped in the manner indicated for glossy leather, and they are put into bucking tubs, containing a weak, warm, soot liquor, about one-third or one-half as strong as at first. The skins are alternately taken out and put into this weak liquor, three or four times, daily, for more than a fortnight; they are afterwards taken to a bucking tub, containing warm liquor in full strength, taking care to steep them in this liquor three or four times a day, until they are thoroughly impregnated; they are then dried, and steeped about half an hour in a vat containing warm water; after this, they are placed upon a marble table, on which they are cleaned, washed, and brushed, three or four times, both upon the grain and flesh sides. The skins being thus prepared, a strong and warm liquor of oak bark is made, and in this they are steeped three or four times, daily, until the opera-

tion is completed. Care must be taken to dry the skins every time they are steeped in this last named liquor.

Process of Tanning Hides with Soot and Tar Waters.

BY THOMAS ASHMORE.

1st. In the process, may be used every kind of soot, produced either by the combustion of bones, and other animal matter—or by that of wood, turf, or other vegetable substance—or by the combustion of tar, pit-coal, and other bituminous products:

2d. Of oils, and other empyreumatic liquids, produced by the distillation of various animal, vegetable, and bituminous matters:

3d. Of every kind of empyreumatic gas, produced by the combustion, or the distillation, of vegetable, animal, or bituminous substances:

4th. Of every liquor with which the gases above mentioned have been washed, or with which they have been in contact.

Preparation of Soot and Tar Waters.

Soot Water.—The soot from the upper part of the chimney only should be made use of, as it is of better quality, and very preferable to that which is formed in the lower part.

With one hundred pounds of soot, are mixed three pounds of quick lime; this mixture is put into a large tub, provided with a stop-cock, and having a double bottom; the soot and lime are mixed with a little cold water; then boiling water is poured on, until the two waters amount to about forty-eight gallons; the whole is left to settle twenty-four hours; after which, as much of this liquor as can be obtained, is drawn from below into a vat, or other vessel. The soot is again mixed with a fresh portion of quick-lime and warm water, in which four pounds of sal-ammoniac are dissolved. This liquor, after remaining twenty-four hours, is drawn off as before, and the same process is continued as long as the soot will yield a liquor whose value will cover the expense.

The liquors thus successively obtained, as above, may be mixed together, or the weakest may be used in place of pure water, with fresh quantities of soot and quick-lime, according to the strength wished for in the liquor; and even the first liquor, which is the strongest, may be rendered, if desirable, still stronger.

Tar Water.—To every ten pounds of quick lime, the same weight of water is added, to reduce it to powder; twenty-four pounds of vegetable tar is also added; the whole is then worked, so as to form a complete mixture. Then pour on about 120 gallons of boiling water, in which have been previously mixed, or melted, twenty-four pounds of sal-ammoniac. This mixture, stirred several times, and after remaining twenty-four hours, is separated from the settlings, and furnishes the tar water, which may be used.

Observations on the two preceding Liquids.

Tar water and soot water may be made by the simple infusion of tar or soot in warm water, and these liquors will convert skins

into leather, but they will be too weak for many uses. A stronger liquor may be obtained by making use of quick-lime and water, but the strongest liquor is that which is made with quick-lime and sal-ammoniac.

Preparation of Leather with these Liquors.

To prepare leather with these liquors, the hair is taken from the skins, and they are worked in the usual manner; then, instead of putting the skins into vats, as the tanners do, they are placed in a large tub, in which they are covered with soot or tar water, which has been rendered clear by filtering through sand, or some other filter; the skins are left, during twenty-four hours, in the liquor; they are then transferred to a tub of quick-lime and water, for twelve hours; after this, they are again put into the tar or soot water; and they are changed from one tub to the other, until they have acquired, internally, a deep brown colour.

The time necessary for this operation depends on the thickness of the skins, the strength of the liquor, the temperature, and other variable causes.

The skins, after having undergone this preparation, are taken out of the liquor, and exposed to a current of air, to dry them; they are then replaced in the soot or tar water, in which they remain forty-eight hours, at most; and coming out of this water, they are immediately put, during an hour or two, into the water of quick-lime, and removed alternately from the liquor to the lime-water, until they are completely converted into leather; finally, they are finished in the usual manner.

[*Journ. des Connais. Us. et Prat.*

Method of Making Soap from certain Animal Substances.

In manufactures, the refuse matter should be turned to account as far as possible. We propose, in the present article, to give directions for making a soap with the refuse matter of wool, cloth, &c.

It is well known that, when wool is combed and prepared for spinning, small parts of it escape, and that in fulling and shearing cloth, also, small parts are separated. These scraps should be collected, to extract from them a soapy substance, which, notwithstanding its softness and fluidity, is very fit for fulling and whitening. The following is the method of preparing it.

Begin by making a strong ley of wood ashes, and add to it one-tenth of lime; pour on it warm water, until an egg will swim on the water, above the ashes; leave this mixture to settle for twenty-four hours, or more, if requisite, keeping the ley at the temperature of about 60° Fah. Pass this ley through a kind of sieve, made of tin plates, with a layer of straw, to prevent the ashes from passing with the ley. Pour this ley, when boiling, upon the particles of wool, at the same time stirring and boiling it carefully; and place this new mixture on the fire, to be there boiled a second time. The soapy substance begins very

soon to thicken. Throw in particles of wool, until the ley is saturated with them, and ceases to take a grayish green colour.

The coarse parts of the shearing of cloths, and the hair of all kinds of animals, are not so readily converted into a soap as the pickings of the combing and spinning of the wool. Thus, when the former are to be used, they must be boiled in a much stronger ley; when it is perceived that the ley is perfectly saturated with wool, and that it no longer changes it into soap, the operation is finished. After cooling, a soft and gelatinous soap is found at the bottom of the kettle, well adapted to various uses.

Observations.

1st. The stronger and hotter the ley is, the more powerfully it acts upon the wool, and the quantity of soapy matter obtained from it will be increased; on the contrary, a weak ley will disengage only a part of the oily matters of the wool, and produce a less perfect soap.

2d. To obtain the same kind of soapy substance, shreds of cloth, and other woollen stuffs, may be used; also, hair of all kinds; but in the use of this latter, a much stronger ley is necessary.

3d. When clean and pure substances are used, the soap produced from them is finer, and of better quality. It is therefore necessary to clean the pieces of wool intended for this use; they are to that end washed in river water, to free them from all impurities they may have contracted in the manufacturing.

4th. If to the mixture in the kettle, common salt is added, as is practised in the soap factories, the soap will be thicker and firmer.

5th. In case of want of care and attention, dirty or dyed wools are used, the soap will have a dirty tinge, and will give the cloths a grayish colour. This is of small consequence in cloths of deep colours, but for white cloths, it is requisite that the soap be drawn from white wools.

6th. Stuffs of deep coloured wools, when a soap not well managed is used, imbibe a disagreeable odour, which is dissipated when the stuffs are washed, and dried in the air.

7th. Soap prepared in this manner, may be used with the same advantage in the manufacture of muslins, cotton cloths, and other cotton fabrics; it may be used in place of common soap, in preparing stuffs before dyeing. The gray tint they then take is not injurious, but becomes of advantage to them in certain colours, because stuffs of cotton then become more susceptible of receiving the colour that it is wished to give them.

8th. If fat substances are added, or waste oil, or grease, the soap is more oily, firmer, and dissolves more readily. We know of a large factory, where no other soap is used.

[*Ibid.*

Suabian Method of Bleaching Spun Cotton and Hosiery.

We have just received from a Strasbourg correspondent, the description of a peculiar method of bleaching cotton yarn and hosiery,

used in Suabia. The operation is very quick, being completed in two days; there is no necessity of a place of great extent—a wash house is large enough; and in this respect, as well as the advantage of being practicable at all seasons, this process becomes interesting to small manufacturers, who cannot go to the expense of a regular bleaching establishment. Furthermore, the manipulations are few, and the workmen can, in a very short time, acquire the routine requisite to bleach with certainty.

A caustic alkaline ley is prepared in the following manner: two measures of quick-lime are put in a pile in one corner of the workshop, taking care that the walls against which the lime is placed are neither planked nor boarded. The lime is then covered gradually with ten measures of good ashes, which is spread equally over it, passing them through a sieve; this heap is sprinkled with water between every layer of ashes, and the cracks produced by the heat and motion in the mass, stopped with wet ashes. As soon as the lime is slacked, and this doughy mass entirely cooled, it is fit to form the ley.

The ley wash is formed by mixing this paste with cold water, then decanting the floating liquor, and lixiviating until no more alkali can be obtained; this liquor, which becomes of a fawn yellow colour, ought to be of a specific gravity of about ten to fifteen degrees of the areometer of Baumé, (1.07 to 1.11.)

For this operation, as well as for all bleaching, a soft water must be chosen, hard water producing frequent failures.

Skeins of cotton are taken, and being carefully untwisted, are tied in hanks, or bundles, to be immersed in the cold caustic alkaline wash; they are left in it during six hours, changing them from time to time.

The ley drained off is put aside, to be employed in a second washing, or for other uses.

The skeins are rinsed in river water, when taken out of the ley. After the rinsing, they are boiled in a bath of the same ley in which soap has been dissolved, in the proportion of six pounds to every seventy pounds of cotton, and ley in proportion, in order to clean them; this bath is kept boiling during twelve hours, in a copper kettle, which must be carefully cleaned after every operation. During the boiling, the cotton must be stirred about, to prevent that which is in contact with the bottom of the kettle, from burning, and to distribute the boiling equally through all the skeins. After coming out of the kettle, the cotton is again washed in river water.

The fifth manipulation is boiling in water without ley; the same proportion of soap is always used, viz: six pounds of soap, for seventy pounds of cotton, or hosiery; after cleansing the kettle well, river water is poured in, and the hanks or bundles are stirred about as before, and for the same length of time. Finally, the cotton is washed for the last time in river water, and then dried in the open air, upon the grass. In cold weather, the use of the grass drying may be dispensed with, and the cotton, &c. dried in a stove. It has been observed that the quicker it dries, the whiter it becomes. It is pre-

sumed, in all these manipulations, that the person who stirs the skeins of cotton, will be careful, and skilful enough, to avoid entangling the threads of the skeins. [*Ibid.*]

¶ *Report on the Progress and Present State of our Knowledge of Hydraulics as a Branch of Engineering.* By GEORGE RENNIE, Esq., F. R. S., &c. &c.

PART I.

The paper now communicated to the British Association for the Advancement of Science, comprises a report on the progress and present state of our knowledge of Hydraulics as a branch of Engineering, with reference to the principles already established on that subject.

Technically speaking, the term hydraulics signifies that branch of the science of hydrodynamics, which treats of the motion of fluids issuing from orifices and tubes in reservoirs, or moving in pipes, canals, or rivers, oscillating in waves, or opposing a resistance to the progress of solid bodies at rest.

We can readily imagine that if a hole of given dimensions be pierced in the sides or bottom of a vessel kept constantly full, the expenditure ought to be measured by the amplitude of the opening, and the height of the liquid column.

If we isolate the column above the orifice by a tube, it appears evident that the fluid will fall freely, and follow the laws of gravity. But experiment proves that this is not exactly the case, on account of the resistances and forces which act in a contrary direction, and destroy part of, or the whole, effect. The development of these forces is so extremely complicated, that it becomes necessary to adopt some auxiliary hypothesis, or abbreviation, in order to obtain approximate results. Hence, the science of hydrodynamics is entirely indebted to experiment. The fundamental problem of it is to determine the efflux of a vein of water, or any other fluid, issuing from an aperture made in the sides or bottom of a vessel kept constantly full, or allowed to empty itself. Torricelli had demonstrated that, abstracting the resistances, the velocities of fluids issuing from very small orifices, followed the subduplicate ratio of the pressures. This law had been, in a measure, confused by subsequent writers, in consequence of the discrepancies which appeared to exist between the theory and experiment, until Varignon remarked that when water escaped from a small opening made in the bottom of a cylindrical vessel, there appeared to be very little, or scarcely any, sensible motion in the particles of the water; from which he concluded that the law of acceleration existed, and that the particles which escaped at every instant of time, received their motion simply from the pressure produced by the weight of the fluid column above the orifice, and that the weight of this column of fluid ought to represent the pressure on the particles which continually escape from the orifice; and that the quantity of motion or expenditure is in the ratio of the breadth of the orifice,

multiplied by the square of the velocity, or, in other words, that the height of the water in the vessel is proportional to the square of the velocity with which it escapes; which is precisely the theorem of Torricelli. This mode of reasoning is in some degree vague, because it supposes that the small mass which escapes from the vessel at each instant of time, acquires its velocity from the pressure of the column immediately above the orifice. But supposing, as is natural, that the weight of the column acts on the particle during the time it takes to issue from the vessel, it is clear that this particle will receive an accelerated motion, whose quantity in a given time will be proportional to the pressure multiplied by the time; hence the product of the weight of the column by the time of its issuing from the orifice, will be equal to the product of the mass of this particle by the velocity it will have acquired; and as the mass is the product of the opening of the orifice, by the small space which the particle describes in issuing from the orifice, it follows that the height of the column will be as the square of the velocity acquired. This theory is the more correct, the more the fluid approaches to a perfect state of repose, and the more the dimensions of the vessel exceed the dimensions of the orifice. By a contrary mode of reasoning, this theory became insufficient to determine the motions of fluids through pipes of small diameters. It is necessary, therefore, to consider all the motions of the particles of fluids, and examine how they are changed and altered by the figure of the conduit. But experiment teaches us that when a pipe has a different direction from the vertical one, the different horizontal sections of the fluid preserve their parallelism, the sections following taking the place of the preceding ones, and so on; from which it follows (on account of the incompressibility of the fluid) that the velocity of each horizontal section or plate, taken vertically, ought to be in the inverse ratio of the diameter of the section. It suffices, therefore, to determine the motion of a single section, and the problem then becomes analogous to the vibration of a compound pendulum, by which, according to the theory of James Bernouilli, the motions acquired and lost at each instant of time form an equilibrium, as may be supposed to take place with the different sections of a fluid in a pipe, each section being animated with velocities acquired and lost at every instant of time.

The theory of Bernouilli had not been proposed by him until long after the discovery of the indirect principle of *vis viva* by Huygens. The same was the case with the problem of the motions of fluids issuing from vessels, and it is surprising that no advantage had been taken of it earlier. Michelotti, in his experimental researches *de Separatione Fluidorum in Corpore Animali*, in rejecting the theory of the Newtonian cataract, (which had been advanced in Newton's *Mathematical Principles*, in the year 1687, but afterwards corrected in the year 1714,) supposes the water to escape from an orifice in the bottom of a vessel kept constantly full, with a velocity produced by the height of the superior surface; and that if, immediately above the lowest plate of water escaping from the orifice, the column of water be frozen, the weight of the column will have no effect on the velocity

of the water issuing from the orifice; and that, if this solid column be at once changed to its liquid state, the effect will remain the same. The Marquis Poleni, in his work *De Castellis per quæ derivantur Fluviorum Aquæ*, published at Padua, in the year 1718, shows, from many experiments, that if A be the orifice, and H the height of the column above it, the quantity of water which issues in a given time is repre-

sented by $2 A H \times \frac{0.571}{1.000}$, whereas if it spouted out from the orifice

with a velocity acquired by falling from the height H, it ought to be exactly $2 A H$, so that experiment only gives a little more than half the quantity promised by the theory; hence, if we were to calculate from these experiments, the velocity that the water ought to have to furnish the necessary quantity, we should find that it would hardly make it reascend $\frac{1}{3}$ rd of its height. These experiments would have been quite contrary to expectation, had not Sir Isaac Newton observed that water issuing from an orifice $\frac{5}{8}$ ths of an inch in diameter, was contracted $\frac{2\frac{1}{2}}{3}$ th of the diameter of the orifice, so that the cylinder of water which actually issued was less than it ought to have been, according to the theory, in the ratio of 441 to 625; and augmenting it

in this proportion, the opening should have been $2 A H \frac{0.850}{1.000}$, or

$\frac{4}{5}$ ths of the quantity which ought to have issued, on the supposition that the velocity was in the ratio of the square root of the height, from which it was inferred that the theory was correct, but that the discrepancy was owing to certain resistances, which experiment could alone determine. The accuracy of the general conclusion was affected by several assumptions—namely, the perfect fluidity and sensibility of the mass, which was neither affected by friction nor cohesion, and an infinitely small thickness in the edge of the aperture.

Daniel Bernouilli, in his great work, *Hydrodynamica, seu de Viribus et Motibus Fluidorum Commentaria*, published at Strasburgh, in the year 1738, in considering the efflux of water from an orifice in the bottom of a vessel, conceives the fluid to be divided into an infinite number of horizontal strata, on the following suppositions—namely, that the upper surface of the fluid always preserves its horizontality; that the fluid forms a continuous mass; that the velocities vary by insensible gradations, like those of heavy bodies; and that every point of the same stratum descends vertically with the same velocity, which is inversely proportional to the area of the base of the stratum; that all sections thus retaining their parallelism are contiguous, and change their velocities imperceptibly; and that there is always an equality between the vertical descent and ascent, or *vis viva*; hence he arrives, by a very simple and elegant process, to the equations of the problem, and applies its general formulæ to several cases of practical utility. When the figure of the vessel is not subject to the law of continuity, or when sudden and finite changes take place in the velocities of the sections, there is a loss of *vis viva*, and the equations require to be modified. John Bernouilli and Maclaurin arrived at the same conclusions by different steps, somewhat analogous to the cataract of Newton. The investigations of D'Alembert had been

directed principally to the dynamics of solid bodies, until it occurred to him to apply them to fluids; but in following the steps of Bernouilli, he discovered a formula applicable to the motions of fluid, and reducible to the ordinary laws of hydrostatics. The application of his theory to elastic and non-elastic bodies, and the determination of the motions of fluids in flexible pipes, together with his investigations relative to the resistance of pipes, place him high in the ranks of those who have contributed to the perfection of the science.

The celebrated Euler, to whom every branch of science owes such deep obligations, seems to have paid particular attention to the subject of hydrodynamics; and in attempting to reduce the whole of it to uniform and general formulæ, he exhibited a beautiful example of the application of analytical investigation to the solution of a great variety of problems, for which he was so famous. The *Memoirs of the Academy of Berlin*, from the year 1768 to 1771, contain numerous papers relative to fluids flowing from orifices in vessels, and through pipes of constant or variable diameters. "But it is greatly to be regretted," says M. Prony, "that Euler had not treated of friction and cohesion, as his theory of the linear motion of air would have applied to the motions of fluids through pipes and conduits, had he not always reasoned on the hypotheses of mathematical fluidity, independently of the resistances which modify it."

In the year 1765, a very complete work was published at Milan, by Paul Lecchi, a celebrated Milanese engineer, entitled *Idrostatica esaminata ne' suoi Principi e Stabilite nelle suoi Regole della Mensura della Acque correnti*, containing a complete examination of all the different theories which had been proposed to explain the phenomena of effluent water, and the doctrine of the resistance of fluids. The author treats of the velocity and quantity of water, whether absolutely or relatively, which issues from orifices in vessels and reservoirs, according to their different altitudes, and inquires how far the law applies to masses of water flowing in canals and rivers, the velocities and quantities of which he gives the methods of measuring. The *extensive and successful practice* of Lecchi as an engineer, added much to the reputation of his work.*

In the year 1764, Professor Michelotti, of Turin, undertook, at the expense of the king of Sardinia, a very extensive series of experiments on running water, issuing through orifices and additional tubes, placed at different heights, in a tower of the finest masonry, twenty feet in height, and three feet square inside. The water was supplied by a channel two feet in width, and under pressures of from five to twenty-two feet. The effluent waters were conveyed into a reservoir of ample area, by canals of brick-work lined with stucco, and having various forms and declivities; and the experiments, particularly on the efflux of water through differently shaped orifices, and additional tubes of different lengths, were most numerous and accurate; and Michelotti was the first who gave representations of the changes which take place in the figure of the fluid vein, after it

* See also *Memorie Idrostatico-storiche*, 1773.

has issued from the orifice. His experiments on the velocities of rivers, by means of the bent tube of Pitot, and by an instrument resembling a water-wheel, called the *stadera idraulica*, are numerous and interesting; but, unfortunately, their reduction is complicated with such various circumstances, that it is difficult to derive from them any satisfactory conclusions. But Michelotti is justly entitled to the merit of having made the greatest revolution in the science by experimental investigation.* The example of Michelotti gave a fresh stimulus to the exertions of the French philosophers, to whom, after the Italians, the science owes the greatest obligations. Accordingly, the Abbé Bossut, a most zealous and enlightened cultivator of hydrodynamics, undertook, at the expense of the French government, a most extensive and accurate series of experiments, which he published in the year 1771, and a more enlarged edition, in two volumes, in the year 1786, entitled *Traité Théorique et Expérimental d'Hydronamique*. The first volume treats of the general principles of hydrostatics and hydraulics, including the pressure and equilibrium of non-elastic and elastic fluids, against inflexible and flexible vessels; the thickness of pipes to resist the pressure of stagnant fluids; the rise of water in barometers and pumps, and the pressure and equilibrium of floating bodies; the general principles of the motions of fluids through orifices of different shapes, and their friction and resistance against the orifices; the oscillations of water in syphons; the percussion and resistance of fluids against solids; and machines moved by the action and reaction of water. The second volume gives a great variety of experiments on the motions of water through orifices and pipes and fountains; their resistances in rectangular or curvilinear channels, and against solids moving through them; and lastly, of the fire or steam engine. In the course of these experiments, he found that when the water flowed through an orifice in a thin plate, the contraction of the fluid vein diminished the discharge in the ratio of 16 to 10; and when the fluid was discharged through an additional tube, two or three inches in length, the theoretical discharge was diminished only in the ratio of 16 to 13. In examining the effects of friction, Bossut found that small orifices discharged less water in proportion than large ones, on account of friction, and that, as the height of the reservoir augmented, the fluid vein contracted likewise; and by combining these two circumstances together, he has furnished the means of measuring with precision the quantity of water discharged either from simple orifices or additional tubes, whether the vessels be constantly full, or be allowed to empty themselves. He endeavoured to point out the law by which the diminution of expenditure takes place, according to the increase in the length of the pipe, or the number of its bends; he examined the effect of friction in diminishing the velocity of a stream in rectangular and curvilinear channels; and showed that in an open canal, with the same height of reservoir, the same quantity of water is always discharged, whatever be the declivity and length; that the velocities of

* *Sperimenti Idraulici*, 1767 and 1771.

the waters in the canal are not as the square roots of the declivities, and that in equal declivities and depth of the canal, the velocities are not exactly as the quantities of water discharged; and he considers the variations which take place in the velocity and level of the waters when two rivers unite, and the manner in which they establish their beds.

His experiments, in conjunction with D'Alembert and Condorcet, on the resistance of fluids, in the year 1777, and his subsequent application of them to all kinds of surfaces, including the shock and resistance of water-wheels, have justly entitled him to the gratitude of posterity. The Abbé Bossut had opened a new career of experiments; but the most difficult and important problem remaining to be solved, related to rivers. It was easy to perform experiments with water running through pipes and conduits on a small scale, under given and determined circumstances; but when the mass of fluid rolled in channels of unequal capacities, and which were composed of every kind of material, from the rocks amongst which it accumulated, to the gravel and sand through which it forced a passage—at first a rapid and impetuous torrent, but latterly holding a calm and majestic course—sometimes forming sand-banks and islands, at other times destroying them, at all times capricious, and subject to variation in its force and direction by the slightest obstacles—it appeared impossible to submit them to any general law.

Unappalled, however, by these difficulties, the Chevalier Dubuat, after perusing attentively M. Bossut's work, undertook to solve them by means of a theorem which appeared to him to be the key of the whole science of hydraulics. He considered that if water was in a perfect state of fluidity, and ran in a bed from which it experienced no resistance whatever, its motion would be constantly accelerated, like the motion of a heavy body descending an inclined plane; but as the velocity of a river is not accelerated *ad infinitum*, but arrives at a state of uniformity, it follows that there exists some obstacle which destroys the accelerating force, and prevents it from impressing upon the water a new degree of velocity. This obstacle must therefore be owing either to the viscosity of the water, or to the resistance it experiences against the bed of the river; from which Dubuat derives the following principle:—That when water runs uniformly in any channel, the accelerating force which obliges it to run is equal to the sum of all the resistances which it experiences, whether arising from the viscosity of the water, or the friction of its bed. Encouraged by this discovery, and by the application of its principles to the solution of a great many cases in practice, Dubuat was convinced that the motion of water in a conduit pipe was analogous to the uniform motion of a river, since in both cases gravity was the cause of motion, and the resistance of the channel or perimeter of the pipes, the modifiers. He then availed himself of the experiments of Bossut, on conduit pipes and artificial channels, to explain his theory; the results of which investigations were published in the year 1779. M. Dubuat was, however, sensible that a theory of so much novelty, and at variance with the then received theory, required to

be supported by experiments more numerous and direct than those formerly undertaken, as he was constrained to suppose that the friction of the water did not depend upon the pressure, but on the surface and square of the velocity. Accordingly, he devoted three years to making fresh experiments, and, with ample funds and assistance provided by the French government, was enabled to publish his great work, entitled "*Principes d'Hydraulique vérifiés par un grand nombre d'Expériences, faites par Ordre du Gouvernement*," 2 vols. 1786, (a third volume, entitled "*Principes d'Hydraulique et Hydronomie*," appeared in 1816;—in the first instance, by repeating and enlarging the scale of Bossut's experiments on pipes (with water running in them) of different inclinations or angles, of from 90° to $\frac{1}{40000}$ th part of a right angle, and in channels of from $1\frac{1}{2}$ line in diameter to 7 and 8 square toises of surface, and subsequently to water running in open channels, in which he experienced great difficulties in rendering the motion uniform; but he was amply recompensed by the results he obtained on the diminution of the velocity of the different parts of a uniform current, and of the relation of the velocities at the surface and bottom, by which the water works its own channel, and by the knowledge of the resistances which different kinds of beds produce, such as clay, sand, and gravel; and varying the experiments on the effect of sluices, and the piers of bridges, &c., he was enabled to obtain a formula applicable to most cases in practice.*

Thus, let V = mean velocity per second, in inches.

d = hydraulic mean depth, or quotient which arises from dividing the area or section of the canal, in square inches, by the perimeter of the part in contact with the water, in linear inches.

s = the slope or declivity of the pipe, or the surface of the water.

g = 16.087, the velocity in inches which a body acquires in falling one second of time.

n = an abstract number, which was found by experiment to be equal to 243.7.

$$\text{then } v = \frac{\sqrt{n g (\sqrt{d} - 0.1)}}{\sqrt{s} - \log. \sqrt{s} + 1.6} - 0.3 (\sqrt{d} - 0.1).$$

Such are some of the objects of M. Dubuat's work. But his hypotheses are, unfortunately, founded upon assumptions which render the applications of his theory of little use. It is evident that the supposition of a constant and uniform velocity in rivers cannot hold: nevertheless, he has rendered great services to the science, by the solution of many important questions relating to it; and although he has left, on some points, a vast field open to research, he is justly entitled to the merit of originality and accuracy.

Contemporary with Dubuat was M. Chezy, one of the most skilful engineers of his time; he was director of the *Ecole des Ponts et Chaussées*, and reported, conjointly with M. Perronet, on the Canal

* *Edinburgh Encyclopedia*, art. *Hydrodynamics*, by Brewster.

Yvette. He endeavoured to assign, by experiment, the relation existing between the inclination, length, transversal section, and velocity of a canal. In the course of this investigation, he obtained a very simple expression of the velocity, involving three different variable quantities, and capable, by means of a single experiment, of being applied to all currents whatever. He assimilates the resistance of the sides and bottom of the canal to known resistances, which follow the law of the square of the velocity, and he obtains the following simple formula:

$$v = \sqrt{\frac{g d}{z s}}, \text{ where } g \text{ is } = 16.087 \text{ feet, the velocity acquired by a}$$

heavy body, after falling one second.

d = hydraulic mean depth, equal to the area of the section divided by the perimeter of the part of the canal in contact with the water.

s = the slope or declivity of the pipe.

z = an abstract number, to be determined by experiment.

In the year 1784, M. Lespinasse published, in the "Memoirs of the Academy of Sciences at Toulouse," two papers, containing some interesting observations on the expenditure of water through large orifices, and on the junction and separation of rivers. The author had performed the experiments contained in his last paper, on the rivers Fresquel and Aude, and on that part of the canal of Languedoc below the Fresquel lock, towards its junction with that river.

As we before stated, M. Dubuat had, with much sagacity classified his observations on the different kinds of resistance experienced in the motion of fluids, and which might have led him to express the sum of the resistances by a rational function of the velocity composed of two or three terms only. Yet the merit of this determination was reserved to M. Coulomb, who, in a beautiful paper, entitled "Expériences destinées à déterminer la Cohérence des Fluides et les Lois de leurs Résistances dans les Mouvements très lents," proves, by reasoning and facts,

1st, That in extremely slow motions, the part of the resistance is proportional to the square of the velocity.

2dly, That the resistance is not sensibly increased by increasing the height of the fluid above the resisting body.

3dly, That the resistance arises solely from the mutual cohesion of the fluid particles, and not from their adhesion to the body upon which they act.

4thly, That the resistance in clarified oil, at the temperature of 69° Fahrenheit, is to that of water as 17.5 : 1; a proportion which expresses the ratio of the mutual cohesion of the particles of oil, to the mutual cohesion of the particles of water.

M. Coulomb concludes his experiments by ascertaining the resistance experienced by cylinders that move very slowly, and perpendicularly to their axes, &c.

This eminent philosopher, who had applied the doctrine of torsion with such distinguished success, in investigating the phenomena of

electricity and magnetism, entertained the idea of examining, in a similar manner, the resistance of fluids, contrary to the doctrines of resistance previously laid down. M. Coulomb proved that, in the resistance of fluids against solids, there was no constant quantity of sufficient magnitude to be detected; and that the pressure sustained by a moving body is represented by two terms, one which varies as the simple velocity, and the other with its square.

The apparatus with which these results were obtained, consisted of disks of various sizes, which were fixed to the lower extremity of a brass wire, and were made to oscillate under a fluid, by the force of torsion of the wire. By observing the successive diminution of the oscillations, the law of resistance was easily found. The oscillations which were best suited to these experiments, continued for twenty or thirty seconds, and the amplitude of the oscillation (that gave the most regular results) was between 480, the entire division of the disk, and 8 or 10 divisions from zero.

[TO BE CONTINUED.]

Accounts of the means employed for the recovery of Treasure, Stores, and other Property, from the Wreck of the Thetis. By Commander DE ROOS, R. N., and Commander DICKINSON, R. N.

The following are abstracts, from the *Proceedings of the Royal Society*, of two papers on the recovery of treasure and stores from the wreck of the *Thetis*, which were read before that learned body, on the 20th and 27th of February, and 20th of March last.

Abstract of "An Account of some Operations executed at Cape Frio, by the Officers and Crew of His Majesty's Ship *Algerine*, for the purpose of raising a part of the Stores, &c. lost in His Majesty's Ship *Thetis*. By the Hon. Commander F. T. De Roos, R. N., F. R. S."

Captain De Roos, who had the command of his majesty's ship *Algerine*, was instructed to take charge of the enterprise commenced by the officers and crew of his majesty's ship *Lightning*, having for its object the recovery of the treasure and stores from the wreck of the *Thetis*, which, in the month of December, 1830, had sunk in a cove to the south-east of Cape Frio. He reached this spot on the 6th of March, 1832, having with him eleven officers and eighty-five men. A certain number of men were appointed to remain on board the ship, which was moored in a harbour about two miles off; a party of artificers and others were employed at the huts which they inhabited near the Cape; and the rest, nearly thirty-five in number, were stationed at the wreck.

The Captain gives a description of Cape Frio, and of the island of which it forms the south-eastern extremity, and which is an immense promontory of insulated granite jutting into the Atlantic Ocean, sixty miles east of Rio de Janeiro. The cove, in the middle of which the wreck of the *Thetis* lay, is a square indenture in the cliffs, six hundred feet deep by as many wide. It is surrounded by nearly perpen-

dicular masses of granite, from one hundred to two hundred feet high, and is exposed to the whole swell of the South Atlantic, which sets in with remarkable force in that direction. The weather is singularly variable; and transitions frequently take place in the course of a few hours, from perfect stillness to the most tremendous swell. The Captain states that he has witnessed few scenes in nature more sublime than that presented by the Thetis Cove during a gale of wind from the south-west.

The Captain enters into a minute description of the mechanical apparatus employed for obtaining the necessary purchases for the various operations which were required, and gives a circumstantial history of his proceedings. Frequent interruptions were experienced from the state of the weather, and the almost incessant agitation of the water, which was often so powerful as to render the diving bell unmanageable, and to expose the divers to serious danger. The diving bell consisted of a one-ton ship's water tank, with eight inches of iron riveted to the bottom, in order to give it more depth, and having attached to it eighteen pigs of ballast, the weight of which (17 cwt.) was found to be sufficient to sink it.

As soon as the necessary arrangements had been completed, the Captain states that he made a minute survey of the bottom, by means of the diving bell, and ascertained the exact position and shape of all the large rocks which covered the spot where the treasures and stores of the Thetis had been scattered. The shape of the area where the precious metals in particular had been deposited, was an ellipse, of which the two principal axes measured forty-eight and thirty-one feet; and large boulders of granite had been subsequently rolled over these treasures, and required to be removed before the latter could be recovered. The superincumbent pressure of the sea, aided by the huge materials of the wreck of the frigate, which, under the influence of the swell, acting like a paviour's hammer, with enormous momentum, had jammed together the rocks, and produced a strong cohesion between the fragments of wood and the gold, silver, and iron.

The first object was to clear away every portion of the wreck; and after this had been accomplished, to loosen and remove all the large rocks in succession, beginning with the smallest, and ending with the largest and most unwieldy. Some of these, which they succeeded in rolling from their situations into deeper water, weighed about thirty or forty tons; and the largest, which it required the greatest efforts to move from its place, was computed to weigh sixty-three tons. This last effort served to show, that no part, either of the wreck or the stores, which was of any value, remained behind; and after fifteen-sixteenths of the property had been recovered, the enterprise, which had so perfectly succeeded, terminated on the 24th of July, and the *Algerine* returned to Rio de Janeiro on the 1st of August.

The Captain subjoins an account of the current off Cape Frio, and a description of the climate, which seems to have been favourable, for his party suffered but little from sickness, and the expedition was unattended with the loss of a single life. On one occasion the party were visited by a whale, which approached very near the div-

ing bell, but fortunately changed its course without doing any mischief.

The narrative commences with the statement of the consternation produced at Rio de Janeiro on the receipt of the intelligence of the loss of the *Thetis*, with a freight of about 810,000 dollars, on the south-west side of the Island of Cape Frio, and of the determination of the author, on finding that no one seemed disposed to take any step towards the recovery of the property thus lost, to make the attempt himself, if he could obtain from the Commander in Chief at that station, Rear Admiral Thomas Baker, C. B., orders to that effect. He accordingly exerted himself to obtain every possible information relative to the nature of the coast, depth of water, and other circumstances, which might enable him to judge of the practicability of the undertaking, and of the means necessary for its successful accomplishment; and became convinced that the difficulties and obstacles to be encountered, although numerous and formidable, might be overcome by the employment of the means which suggested themselves to him as practicable on this occasion, if sufficient assistance were afforded him in putting them into execution. He accordingly had models of the proposed machinery made, and submitted them, together with his plan, to the Commander in Chief, by whom they were approved. He experienced great difficulty in procuring a suitable diving bell, for it was impossible to obtain any instrument of the kind at Rio de Janeiro, or even any facilities for the construction of one by casting. It at length occurred to him, that a ship's iron water tank might be converted to this use; and being supplied with one from the *Warspite*, he was enabled to render it available for that purpose. The next difficulty was to procure an air-pump, which, after much delay, owing to the tardiness of the native workmen in that country, was at length constructed. The want of air-hoses, however, was a still more formidable obstacle to the success of the plan; but the ingenious contrivances of the author for rendering the common pump hoses air tight, supplied this deficiency; and on a trial which he made with the whole apparatus on the 22d of January, 1831, it was found to answer completely. The next day he received his orders from the Commander in Chief, and, sailing on the following day, arrived at the harbour of Cape Frio on the 30th, and immediately proceeded to inspect the coast, and ascertain the situation of the wreck, not a vestige of which was visible. An account is then given of the local circumstances of the *Thetis* Cove, or inlet, surrounded by almost perpendicular cliffs, from 168 to 194 feet in height, with a depth of water varying from $3\frac{1}{2}$ to 24 fathoms, and the bottom being strewn with huge perpendicular rocks, occasioning these inequalities. These surveys showed that the execution of the plan originally conceived by the author was opposed by so many unforeseen difficulties, that he was obliged to relinquish some part of it, and resort to fresh expedients for surmounting them. The idea of constructing a derrick then occurred to him, but the materials were wanting, for no trees existed in the island, except those in the forests in the interior, which were inaccessible from their distance and the heights on which they grew,

and of which the wood was, from its quality, unsuitable to the purpose. His only resource, therefore, was to make it of the fragments of spars saved from the wreck. With great exertions, a circumstantial account of which is given in the paper, the work was at length accomplished; and the result fully equalled the anticipations which had been formed of its utility in affording a stable point of support for the operations with the diving bell. Previously to the erection of a derrick, however, much had been done by working the diving bell from a boat, and a considerable quantity of stores and treasure raised. At one time the anxiety of the author to forward the undertaking, and avail himself of favourable weather, induced him to try the experiment of working by torch-light, which succeeded to a certain extent; but after a few trials the danger was found to be excessive, and the fatigue to the divers so great as to oblige him to desist.

After the derrick had been for some time in operation, a tremendous sea arose, the shock of which, for want of sufficient materials to support it, effected its destruction; and a substitute was then resorted to by the setting up of a suspension cable diagonally from the cliffs, which, after great difficulties, was at length effected.

A great portion of the narrative is occupied with details of the various proceedings, and of the serious impediments which were successively overcome by the zeal, perseverance, and extraordinary exertions of the officers and crew, under the orders of Captain Dickinson, subjected as they were, for so long a period, to the greatest privations and hardships, arising from the labourious nature of the work, the unhealthiness of the climate, the attacks of the chigger, (producing distressing ulcers in the feet,) the annoyance from drifting sand, which penetrated into every place, the exposure to constant wet in huts which could not be made to exclude either wind or rain, and the perils arising from the boisterous gales and tremendous swell of the sea, which the whole ship's company, but more particularly the men in the diving bell, had to encounter; forming a combination of difficulties which the author is convinced could have been surmounted by none but British seamen.

After having succeeded so far in the undertaking, and made, at various times, shipments for England of treasure amounting to about three-fourths of the whole which had been on board the *Thetis* when she sunk, orders were received by the author, on the 6th of March to resign the charge of the enterprise to the Honourable Captain De Roos, of his majesty's brig *Algerine*; on the receipt of which he immediately ordered a survey to be taken of the stores, and on the 9th descended in the bell, surveyed the bottom of the cove, ascertained the position of the remaining stores, and a considerable quantity of treasure; and after having communicated the whole of the results to Captain De Roos, instructed him, his officers and ship's company, in the way of working the bell, as well as in the different modes of removing rocks, recovering stores and treasure, and the use of the whole of the machinery, and furnished him with every necessary information for his guidance; he lent twenty of his men to the *Algerine* for their

assistance, resigned the charge to his direction on the 10th, and sailed for Rio de Janeiro on the 13th.

On the Effects of Size in Mechanical Construction.

The influence of size upon the strength and forcible motion of machines and mechanical structures generally, is strikingly exhibited in the difference between the results obtained from models of machines, and the results of the same machines executed on a large and powerful scale.

When a new theory or fundamental proposition in science is put forth, or when a new machine is invented, we frequently find conclusions drawn from experiments made with small models, which are not supported afterwards by the results of practice on a large scale; and hence practised engineers put very little faith in the results obtained by experiments with models.

There are several reasons for this frequent discrepancy between experimental and practical results, and the same reasons do not operate in all cases; it is useful therefore to distinguish between them.

One reason why the effect of a model of a machine is very frequently no index of the effect of the machine itself, is, that the *intensity of operation* of the properties of matter is not always proportionate to the mere *quantity of matter*; that is, there is, in respect to all matter, a certain point at which its properties *begin to act*, and before which they are only *latent*. And in models, very frequently, that point is not reached at all.

For example, let us take *vibration*.

A *heavy iron chain* suspended between two points, may, by setting it swinging, be broken by its *own vibration*. But if a very *slender wire* were suspended between two points proportionably distant from each other, it would be impossible to cause it to break by its *own vibration*.

The reason of the difference of results is, that the cause of fracture is the *momentum acquired by the body in motion*; which momentum, being governed by the *weight* and *square of the velocity*, may easily be caused, in the case of a heavy chain, to *exceed the ultimate strength* of the chain.

But in the case of a fine wire, the *weight* being next to nothing, the momentum requisite to cause fracture can only be produced by combining the weight with a *very high velocity*; a velocity in fact so high, that it would be, from the nature of the experiment, almost impracticable to obtain it.

Hence the point at which *effective vibration* begins, is beyond the limits of a trial with a wire, and within them in a trial with a chain.

Again, in respect to *friction*: in all bodies that we know, the particles require a certain time to yield to *forcible disturbance* of their positions. This is the reason why a boat drawn through the water at a very high velocity, rises towards the surface, and has its displacement diminished. The number of particles of water displaced re-

quires a greater time to yield to the force applied to each successive layer of particles, than is allowed to them by the velocity of the boat. Hence *the boat* is compelled to yield, and run above those particles which it cannot disturb.

The same is probably the reason of the *ascertained fact*, that "the draught of a stage coach on a common turnpike road, increases in a *less ratio than the velocity*;"* and of the most probable fact, that the same law obtains in respect to rail-road carriages. That is, in both cases, the materials of the road are of the nature of fluids, in so far, that bodies laid upon them, which have sufficient weight to cause *any sensible friction*, do so by *sinking into the substance of the material*, perceptibly or imperceptibly. And the carriage wheels, when put in motion, must either crush all those particles which lie in front of them, or displace the particles, or else be displaced by them.

Now because the particles of the road, whether iron or stone, require (like the particles of other bodies) a *particular time* (according to their particular nature) to yield to force, and be disturbed without being crushed, it follows, that unless the superincumbent weight be sufficient to *crush* the particles, it will, if the increments of its motion be greater than the time required by the particles of the road to yield to its force, be lifted up above those particles which it can *neither crush nor displace*. By this rising partially out of the medium in which it moves, it becomes a body of less displacement, and meeting fewer particles, will have less friction, if its velocity be maintained.

Now all this theory depends upon observations which could not be made satisfactorily in experiments on a small scale; because the thing to be observed is the operation of properties of matter, which are *latent* up to a certain point; that is, the compressibility of a good turnpike-road, or of an iron rail-road, is latent, until a *certain amount of weight* be applied upon it, and that amount would be unattainable in a model. Hence experiments upon plans for impelling locomotive carriages, where the advantage or disadvantage depends upon the question of increase or diminution of friction, are inconclusive when conducted on a small scale, because they *never bring the resistance sought to be measured, into operation*.

In all experiments, therefore, before settling the size of the models, or indeed before determining whether models shall be used at all, it should be ascertained whether the forces that will be brought into play in them, will be of *sufficient absolute intensity* to act at all upon the *forces of resistance* they will encounter; because, if too small to do that, it is plain that they are quite useless, and are no index whatever to the real operation of the machines constructed after them. Another reason why the results of experiments with models are so often inconclusive is, that the operations being on a very small scale, and *all the quantities* proportionably small, their *differences* are necessarily too minute to be accurately estimated, and very small errors lead to very erroneous inferences. And further, in constructing models, we seldom observe that proportion between *the strengths and forces of the operative parts*, and the *strengths and forces of the resisting parts*,

* Vide Sir H. Parnell on Roads, p. 337. Mr. McNeill's Paper.

which we must observe in a large structure; and the mind is usually inclined to make small things over strong, so that defects of principle escape under cover of a mass of matter.

Errors have clearly been traceable to these sources in some instances where works have been executed on a small scale, and have answered; and on a large scale, precisely on the same principle, and have failed.

In the early periods of constructing suspension bridges, many of small size were made with the platform supported by inclined wires, which stood very well. Afterwards, a large one was attempted on the same plan, and was broken down by a gale of wind. There is no reason to suppose that it failed from bad proportions or bad workmanship; but the reason of the difference of results was, that the principle of the construction is defective, because the chains, if drawn nearly tight, are too much weakened, and if left slack, forming all different curves, their vibrations (produced by a gale of wind) are unequal in amount, and hence each does not bear its fair share of strain.

This defect of principle would remain latent in a *small structure*; first, because there would most likely be a great superabundance of strength; secondly, because the whole mass of matter would be too light to injure itself by its own vibration. But when the same principle was carried into a larger structure, the force brought into operation by motion of the parts would be greatly increased; the strength of the parts would most likely not exceed so much the resistance to be overcome, and the defect of principle ceased, therefore, to be latent.

Again, in constructing *steam engines*. The bell crank engine, made of a small size, answered very well; it was attempted on a large scale, and failed. Now the defect of the bell-crank engine is, that it is out of balance; the piston being *urged* by its own weight, and that of the parts connected with it, in addition to the force of the steam, in the *down stroke*, and being *resisted* by the same weights in the *ascending stroke*. This defect of principle was latent while the machine was of small power; because the weight that acted in an injudicious manner was so small in proportion to the mass, and strength, and hardness, of the materials, as not to acquire sufficient momentum to affect sensibly the stability of the structure or the wear of the materials: but in a large machine, the hardness of the materials remained the same, and the mass of matter that had to endure the force transmitted through it, and was probably (on the principle that large structures are usually made weaker in proportion than small ones) much less in proportion to the amount of force transmitted than in the small engine. Hence the defect of principle became sensible.

Lastly, the extraordinary results said to be obtained lately in experiments upon an undulating rail-way, and the inferences drawn from them by many not firm in their mechanical faith, are a striking example of that cause of error which springs from overlooking some effects or circumstances, and the differences between quantities observed, on account of the minuteness of the quantities dealt with.

It is affirmed, and I believe with truth, that in those experiments a model of a locomotive carriage, impelled by a spring, performed a

given horizontal distance on an undulating rail-way, in less time than it performed the same horizontal distance on a horizontal rail-way,—all other circumstances, except that of horizontality and undulation, being *apparently* alike; and hence a total subversion of received principles was inferred. The error of the inferences arose from its not being at first observed, that in the case of the horizontal line, the model had *more disposition to forcible motion left in it after performing its journey*, than it had on the undulating line: nor did it require any extraordinary neglect to allow such a fact to pass unnoticed, as the difference was probably so minute as to be hardly perceptible, unless measured by some delicate instrument.

In conclusion, therefore, I would observe, that experiments with models, to be at all relied on, should be conducted with the most minute attention, to endeavour to place them under like circumstances, in all respects, to those that will take place in practice on a large scale; that they should never be resorted to when experiments on a large scale *can be made*; and that they should never be trusted, under any circumstances, as furnishing more than *data to judge of probable effects*.
(*Lond. Journ.*)

¶ *Iron Steamboat.*

A large iron steamer, 96 feet long, was lately launched at Selby, built by Mr. Fairburn, of Manchester, for Swiss owners, and is intended to ply on the Lake Zurich. She will be navigated as far up the Rhine as possible, and then taken to pieces, and carried overland to her destination. She draws less than twelve inches water, without cargo. This steamer was built at Manchester, taken to pieces and brought to Selby, put together and launched, and when taken out of the water, will again be taken to pieces, carried overland a distance of forty miles in a rugged country, and ultimately launched at Zurich; and, after all this, will be considerably cheaper and better than if built on the continent.—*Mech. Mag.*

¶ *Human Strength.*

From experiments made at Portsmouth dock-yard, in driving and pressing in iron and copper bolts, a man of medium strength, striking with a mallet, weighing 18 lbs., and the handle 14 inches long, would start a bolt about one-eighth of an inch every blow. It required a pressure of 107 tons to press the same bolt down the same quantity of space, but a small additional weight pressed it completely home.
[*Ibid.*]

¶ *Scotch India Muslins.*

We have recently been assured that a piece of muslin, manufactured at Paisley, was purchased in India by the son of the manufacturer, and sent home as a specimen of the superiority of the products of the Indian loom.
[*Athenæum.*]

CELESTIAL PHENOMENA, FOR FEBRUARY, 1835.
Calculated by S. C. Walker.

Day.	H'r.	Min.					
2	8	22	Im.	26 Ceti,		,6,7, N44°	V92°
2	9	41	Em.			14°	64°
13	5	41	Im.	46 i Leonis,		,6, 118°	70°
13	6	21	Em.			214°	169°
16	12	30	Im.	66 Virginis,		,6, 38°	331°
16	13	15	Em.			286°	250°
20	16	39	Im.	33 Ophinch,		,6, 126°	101°
20	17	20	Em.			194°	174°
28	6	14	N. App.	☽ and 249 Piscium, .7, ☽ N. 3',4			

Meteorological Observations for November, 1834.

Moon.	Days.	Therm.		Barometer.		Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sum morn.	2 P.M.	Sum morn.	2 P.M.	Direction.	Force.		
☉	1	39°	50°	inches 30.29	inches 30.65	E.	Moderate.	0.12	Cloudy—lightly cloudy—rain, hail Snow—cloudy. [& snow in night
	2	30	40	.70	.70	N.E.	do.		Clear day.
	3	26	44	.30	.30	N.E.	do.		Clear—lightly cloudy.
	4	37	53	.35	.15	SW.	do.		Cloudy—clear.
	5	46	48	29.90	29.90	E. NW.	do.		Cloudy—clear.
	6	33	48	30.00	30.15	N.	Bustering		Clear—cloudy—with a heavy gale
	7	31	57	29.90	29.85	NW.	do.		Clear day.
	8	44	52	.80	.90	W. NW.	do.		Clear day.
	9	32	49	30.20	30.20	NW. S.	Moderate.		Clear day.
	10	33	52	.00	.00	SW.	Calm		Clear—lightly cloudy.
	11	45	47	.00	29.85	NW.	Variable.		Cloudy—rain.
	12	31	45	29.95	.85	WSW.	Moderate.	0.07	Cloudy—rain.
	13	34	54	.85	.90	SE.	Calm.		Cloudy—rain.
	14	46	51	.50	.30	SE.	do.	0.13	Cloudy—rain.
	15	23	31	.91	.91	NW.	do.		Cloudy—rain.
	16	20	30	30.65	30.65	N.E.	Moderate.		Clear—rain.
	17	23	32	.85	.90	N.E.	do.	1.45	Clear—rain.
☽	18	44	47	29.61	.60	NW. W.	Bustering		Clear—rain.
	19	43	47	.70	.65	W.	do.		Clear—rain.
	20	37	46	.65	.65	N.	do.		Clear—rain.
	21	34	43	.65	.63	W. NW.	do.	0.04	Clear—rain.
	22	32	51	.75	.60	SE. S.	do.		Clear—rain.
	23	36	43	.60	.65	W. NW.	Bustering		Clear—rain.
	24	33	35	.75	.75	W.	do.		Clear—rain.
	25	29	33	.65	.65	W.	do.		Clear—rain.
	26	28	40	.74	.80	W.	Calm.		Clear—rain.
	27	26	44	.95	.95	W.	Moderate.		Clear—rain.
	28	34	45	30.00	30.00	SW.	do.	0.40	Clear—rain.
	29	36	50	29.86	29.60	SW.	do.		Clear—rain.
	30	36	46	.90	.90	W.	do.		Clear—rain.
☾	Mean	34.57	45.10	29.93	29.91			2.21	Clear—rain.

Thermometer.

Maximum height during the month, 57. on 7th,
Minimum do. 20. on 16th.
Mean do. 39.83

Barometer.

30.85 on 17th.
29.50 on 14th.
29.92

JOURNAL
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State of Pennsylvania,
DEVOTED TO THE
MECHANIC ARTS MANUFACTURES, GENERAL SCIENCE,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

FEBRUARY, 1835.

Remarks and Calculations on the Best Form for Railway Bars, and on the defects which exist in the present method of supporting the same. By R. STEPHENSON, Engineer.

It is abundantly proved, both by experiment and mathematical demonstration, that when a beam is supported at both ends, and sustains a load, either uniformly distributed over the whole length, or placed at any point between the supports, it is of equal strength throughout, if the form be a semi-ellipsis. In practice, this form is almost invariably adopted as the most economical, giving the greatest strength with the least quantity of material, especially in cast iron, which admits of the elliptical shape being accurately given to the beam. So long, therefore, as cast iron was employed for railway purposes, the elliptical rail was adopted by common consent. The circumstance, also, of this kind of rail, when carefully proportioned, scarcely ever breaking in precisely the same part of the length, proved experimentally that the form given to them was a close approximation to that of equal strength.

On the substitution of malleable, for cast, iron for railway bars, it was considered impracticable to give the elliptical shape to the rails; the first malleable iron rails were, consequently, made parallel, or

uniform in depth, throughout the whole length between each bearing. This deviation from the elliptical form was deemed, by some engineers, a serious defect; so much so, that the extension of the use of the malleable iron for railway bars, was for some time retarded: this difficulty, however, was surmounted by an ingenious application of an eccentric roller, by which a form was produced, which, though it did not correspond accurately with the equation of the ellipse, yet approached it so nearly as scarcely to admit of any deviation being made with advantage.

Since the introduction of this form for malleable iron rails, some engineers have returned to the original parallel rail, conceiving that the application of the eccentric roller tends to destroy the uniform arrangement amongst the fibres of the iron, which in the parallel rail may be reasonably considered to extend uninterruptedly from end to end of the rail, which is, consequently, better prepared to withstand the kind of strain to which it is to be subjected.

How far this anticipation is correct, is evidently more a matter of experiment than of calculation; it may, however, be interesting, in the first place, to compare the relative theoretical strengths of the elliptical and parallel rails, on the supposition that they are of the same weight for a given distance; and afterwards to compare the theoretical deduction with experiment, which will show the dependence to be placed on the application of the formula to cases where experiment is not within reach.

It is well ascertained that the transverse strength of beams varies directly as the breadth and square of the depth, and inversely as the length. It may be represented thus, $\frac{b \cdot d^2}{l}$; when b = breadth, d = depth in the middle of the length, and l = length. In comparing the parallel and elliptical rails, the breadth and length may be taken as constant; the relative strength will therefore vary as d^2 . Now, if d = depth of the elliptical rail in the middle, and x = the difference of depth between the middle and the ends, (or what is usually denominated ‘the belly of the rail,’) $d - \frac{1}{2} x$ will be, nearly, the depth of a parallel rail of equal weight; the relative strengths of the two rails will therefore be as $d^3 : (d - \frac{1}{2} x)^3$, or, $1 : \frac{(d - \frac{1}{2} x)^3}{d^3}$.

The last fraction is clearly less than 1; consequently, the strength of the parallel rail must always be less than the elliptical, and will depend on the magnitude of x , or the swell of the rail.

In the view just taken, it will be observed that the projecting ledge on each side of the vertical rib, forming the surface of the rail, has made no part of the consideration, because it is common to each kind of rail. It is not difficult to introduce it, but it would add to the intricacy of the formula, and would give a result a little more in favour of the elliptical rail, as it would elevate the neutral axis, and thus operate in favour of that rail which has the greatest depth.

The above formula applies merely to a vertical pressure; but as

railway bars are also subject to severe lateral strains, it may be well to point out, in this respect, where the elliptical rail still has the advantage.

A lateral strain upon a railway bar is evidently nothing more than a vertical pressure, if the rail be supposed laid upon its side; the same formula then applies, making b and d change places; for what was the breadth in the former case, now becomes the depth, and as the depth and length are supposed the same, the relative strengths will be directly as the breadths; that is, as $b : (b - \frac{1}{2}x)$.

These results are, however, only applicable to the calculation of the ultimate strength; but in considering the relative advantages of railway bars, the ultimate strength of which ought, in all cases, far to exceed the working strain, it would appear that the quantity of deflexion, rather than the breaking load, ought to be the measure of their comparative merits.

It will be readily admitted, on a little consideration, that great, if not absolute, rigidity is extremely desirable in a railway bar; and, though it may be impossible to attain this object, we are justified in making every effort to approach it, by adopting that form of rail which possesses the greatest stiffness, with the least quantity of material. It is in this respect that the increased depth of the rail, obtained by making the longitudinal section a semi-ellipsis, produces a very sensible advantage, and places the merits of the latter form in a much stronger light, than the comparison of the ultimate strengths.

The stiffness, or rigidity, of beams has been proved by Barlow, Young, Tredgold, and others, by a great variety of experiments, to vary directly as the breadth and cube of the depth, and inversely as the cube of the length. When, therefore, the lengths and breadths of the two beams are the same, the relative stiffness will be as the cube of the depth only. Now, the depths at the middle of an elliptical and parallel rail of the same weight, have already been stated to be as $d : d - \frac{1}{2}x$. The relative stiffness will therefore be as $d^3 : (d - \frac{1}{2}x)^3$, or as $1 : \frac{(d - \frac{1}{2}x)^3}{d^3}$, a proportion much more in favour of the elliptical rail, than that previously stated as representing the ultimate strength.

This ratio, it must be observed, requires modification, owing to the circumstance of a parallel beam being more rigid than an elliptical beam of the same depth in the centre; this deduction, however, is not such as to interfere in a great degree with the result indicated by the formula, as will be shown by the experiments adduced in the sequel of these remarks.

In determining the form of railway bars, little, if any, attention has been paid to the question of deflexion; it appears, therefore, the more necessary in this instance to consider its effects, as it is apprehended that it is productive of several injurious consequences, which have hitherto been attributed to a wrong cause. The usual method of uniting the rail chairs and blocks, by keys and pins, tends clearly to form the whole into an inflexible line, no one part being capable

of changing its position, without producing a corresponding change, or distortion, in the adjoining one. Immediately, therefore, on the slightest deflexion taking place in the rail between the supports, the position of the key which connects the rail and chair is disturbed, as it necessarily has a tendency to assume the same angular position as the rail. If this tendency is resisted by the grooved recess in the chair, for the reception of the key, the effect is merely to transfer the tendency from the key to the chair, which is thereby made to rest on one side, or arsis, of its base, and on the other alternately. This continual transfer of strains from the rail to the key, from the key to the chair, and, finally, from the chair to the block, or sleeper—originating from the deflexion of the rail—never fails to destroy one or both of these connections; thus giving rise, not merely to perpetual expense in replacing keys, but to a continual jarring noise when carriages pass over them, from the looseness of the rail and key in the chair. Now, it being absolutely impossible to make the rail between each two supports perfectly inflexible, it seems only reasonable to conclude that every attempt to connect the parts, so that one portion of the structure partakes, in a greater or less degree, of the movements of the adjoining one, must be abortive. This is on the supposition that the inevitable deflexion in the rail is the only source of derangement; but when we add to this, the constant settling of the foundation upon which the blocks are placed, as well as the unequal yielding of the same, which destroys the parallelism between the surface of the rail and the bed of the block, the consequences just alluded to present themselves with increased force.

These reflections appear to countenance the conclusion that much advantage would be derived from the adoption of some method of connecting the rail and chair, which would admit of deflexion in the rail, as well as a change in the position of the block, without destroying the accuracy and efficiency of the connections.

A model of rail and chairs, contrived with the view of obviating the imperfections arising out of what may be termed the "inflexible" plan of connecting the rail and chair, accompanies these remarks. The method described by the model is not affirmed to be free from objection, but is suggested as much less objectionable than the method usually followed, and may be regarded as a step towards that perfection which, it is hoped, will, ere long, be attained in this very important part of the construction of a railway.

If the view here taken be correct, that is, if the deflexion of the rail is one of the principal causes of the present rapid working loose of the rails, keys, and chairs—which would continue to be the case, even after the road has obtained a firm and solid foundation—it is evident that, in order that the quantity of deflexion may be diminished, a stronger rail than has been hitherto employed, is desirable, independent of any consideration in reference to increased weights to be conveyed.

The next, and perhaps the most apparent, cause of derangement in the accuracy of a railway, is the yielding of the material which supports the road; and as the practical operation of this shrinkage

points to a comparison between the parallel and elliptical rail, it may be well to direct attention to it in an especial manner.

When a malleable iron railway bar is first laid and adjusted, each support throughout the five yards, (the ordinary length of each rail,) may be considered as duly performing its part. Immediately on any of the intermediate supports yielding, or falling below the general level, from the unsoundness, or from the consolidation, of the ballasting, the block is forced, by the superincumbent weight, deeper into the ground; as soon as the weight has passed over, the elasticity of the iron (which is not destroyed) causes the surface of the rail to resume its original level; it cannot, however, do this, without lifting the block from the bed, or foundation, into which it was forced, during the progress of the weights along the rail. This effect is not perceptible, until the operation has been frequently repeated; but it is easy to perceive that, as long as the elasticity of the rail remains perfect, and the solidity of the foundations of the road imperfect, the operation of alternately forcing the block deeper into the ground, and suspending it by the elasticity of the rail, must, as a necessary consequence, be going on in every railway where long malleable iron rails are employed, with several supports under each rail. It is obvious that each block so lifted, (on weights being passed over the rail,) must be forced as by a violent blow upon the foundation, thus rapidly accelerating the sinking of the ballasting, and the destruction of the parts, when once allowed to become defective. Now, the tendency to the operation just described, can only be counteracted by increasing the weight of the blocks, and diminishing the elasticity of the rail at the point of bearing; it is, however, impracticable to adopt either of these expedients to an extent that would, in a material degree, approach to the removal of the effect, because any feasible increased weight of block is inappreciable, when compared with the elasticity of the rail. The effect is mentioned in this place, merely to prove that the reduction in strength at the point of support ought not to be looked upon as a defect in the elliptical rail; indeed, it may be made to appear that such a reduction is desirable, rather than the contrary: it will, therefore, be necessary to show that these observations respecting the suspension of the blocks, and the rapid succession of violent blows, like that of a ram, upon the ballast, are not merely ideal.

This is forcibly illustrated by a comparison of the expense of keeping malleable and cast iron railways in order, the latter scarcely exceeding one-half the former, and in some cases (if report is to be received) rather less than that proportion.

It may, perhaps, be objected, that a comparison between cast and malleable iron, on different railways, is not a suitable criterion, as the traffic and speed may be so far different as to account for the difference of expense; this objection is, fortunately, not tenable, as applied to the Darlington Railway, because there the cast iron rails are placed on an embankment, over which the traffic and speed are the same as on other parts of the line. Here the comparison is decid-

edly in favour of the cast iron, and, as I have been informed, in about the proportion above stated; and, although I have not been able to obtain an exact detail of the expenses of each, the chairman of that railway company informed me that, after careful and minute examination, he had completely satisfied himself on the point, and as it corroborates my own observations, I am led to regard it as a well established fact. The only difference in construction between the two descriptions of rails, consists in the cast iron rail having a flexible joint above each support; when, therefore, the foundation sinks, the blocks sink with it; but, there being no reaction, from the elasticity of the rail, the blocks never become suspended; consequently, the ram-like action is never called into play. This leads to the conclusion, that flexibility above the supports is not so weighty an objection to the elliptical rail as has been imagined.

It has been sometimes urged as an advantage in favour of the parallel rail, that the great strength above the supports enables it to sustain the load, even though the block may have sunk below the original level. If this be true, it appears to amount to little more than an admission that it is unnecessarily strong when supported by the blocks, which it in fact always is, because the deflexion of any railway bar of the ordinary strength, where the supports are six feet apart, would be so great as to render rapid velocities more destructive than they are; for the deflexion, being directly as the cube of the length, would be eight times greater than where the rail is supported at every yard; moreover, the supports of a railway should never be allowed to assume that condition, in which one-half of the blocks are supposed to become useless. Preparing, therefore, by the adoption of parallel rails, for circumstances which it is not only practicable to avoid in a public line of road, but ought never to be allowed to take place, appears at least unnecessary; but when it is recollected, in addition to this, that the material thus expended in adding strength to the rail, above the supports, may be applied to other parts of the rail, where strength is more required, it certainly increases the inducement to follow the elliptical form.

The difficulty of manufacturing, and a proportionate increase of expense in, the elliptical rail, have, it is believed, been the principal causes of its rejection by some. To these I have endeavoured to give the most impartial consideration; and with respect to the difficulty of manufacturing, if any really exist, I am convinced it arises from inexperience, as the operation consists, in addition to the rolling of ordinary bar iron, of merely once or twice passing it through the rollers by which the elliptical shape is given. That this should be considered a difficulty, creating an objectionable expense, is somewhat remarkable, since it occupies but a few seconds.

It is not improbable that the true source of this objection, (which arose originally, I believe, with some iron-masters,) is to be found in the fact that it is difficult, if not impracticable, to introduce into the elliptical shaped rail, iron of inferior quality, as the nature of the process almost invariably detects it. This is a recommendation so palpable, that an endeavour has been made to countervail it, by stat-

ing that the process by means of the eccentric roller destroyed the continuity of the fibres, and injured the strength of the rail. Experiment, of course, is our best guide, and on referring to this test, it does not countenance the supposition that iron, of the best quality, is sensibly injured by the process of rolling into the elliptical form. An examination of the table hereafter referred to, will be a sufficient reply to this objection.

[TO BE CONTINUED.]

Experiments, made to determine whether Light exhibits any Magnetic Action. By JOHN W. DRAPER, *Christiansville, Mecklenburg Co., Va.*

"The more refrangible rays of light are said to possess the property of rendering iron and steel magnetic. The existence of this property was first asserted by Dr. Morichini, of Rome. Other observers subsequently failed in obtaining the same results; but in the year 1825, the fact appeared to be decisively established, by the learned and accomplished Mrs. Somerville, in an essay published in the *Transactions of the Royal Society*. In her experiments, sewing needles were rendered magnetic, by exposure for two hours to the violet ray, and the magnetic virtue was communicated in still shorter time, when the violet rays were concentrated, by means of a lens. The indigo rays were found to possess a magnetizing power, almost to the same extent as the violet, and it was observed, though in a less degree, in the blue and green rays. It is wanting in the yellow, orange, and red. Needles were likewise rendered magnetic by the sun's rays, transmitted through green and blue glass. These results have been verified by M. Zantedeschi, of Pavia, (*Bibl. Univ. for May, 1829*,) but their accuracy has been doubted by Messrs. Riess and Moser, who consider that the means employed by Mrs. Somerville, for ascertaining the magnetic state of the needles, were not sufficiently exact. They found the oscillation of needles to be wholly unaffected by exposure to the prismatic colours, (*Brewster's Journal, 2, p. 225, N. S.*) This must still be regarded, therefore, as one of the disputed points in science." (Turner.)

It has been supposed that this disparity of results arose entirely from local circumstances. A hazy atmosphere, such as is met with in the northern and middle countries of Europe, might perhaps influence, in some manner, this peculiar property of light, when the clearer sky of Italy allowed an opportunity of making the experiment. Some indeed have thought that the observers who were said to have verified the original results of the Italian philosopher, were themselves deceived, in not having previously ascertained the magnetic state of the needles they used. That mistakes of this, and a similar kind, are easily made, will appear in the course of this communication.

During the past summer, I have attempted to satisfy myself whether the more refrangible rays really exert any magnetic influence,

and happening to reside in the south of Virginia, upon the same parallel of latitude as Tunis, and the more northerly African kingdoms, I thought the situation too favourable to suffer such an opportunity to pass, without endeavouring to gain some decisive information on this contested point.

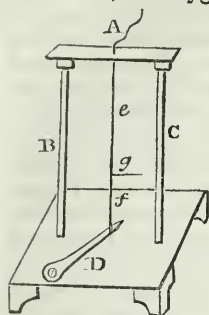
The sky of that part of Virginia is not, however, so bright as might be expected. When unclouded, it is of a clearer blue than the sky of England, and, I think, rather darker, approaching, by several shades, nearer to the tint of Prussian blue, than that azure colour which it has in the latter country. During a residence of twelve months, I saw it twice of that intense complexion which they say it has in the tropical regions. The moon appeared globose, and her centre to bulge out like a ball, and the planet Venus might be fancied to exhibit a well formed crescent. The air passes from great moisture to dryness, with rapidity; a good barometer is seldom at rest. The temperature of the sun-beam is sometimes 132 F., but the syphon barometer seldom varies more than one inch. Clouds form and rise with great rapidity, the seasons are uncertain, and the atmosphere is often deformed with a mistiness that obscures distinct vision. But the dense clouds that gather in the west, of an evening, emulate the beauty of a sunset on the Atlantic ocean.

I am thus particular in describing the state of the atmosphere in which these experiments were made, because much stress has been laid upon that circumstance, as materially affecting the results of magnetic action of the solar ray. And, as the experiments now to be detailed lead to a negative decision, it is well to explain under what circumstances they were performed, that those who have come to an opposite conclusion may have an opportunity of pointing out whether it is really owing to the state of the atmosphere.

In the year 1824, Mr. Christie found that a needle, six inches long, contained in a brass compass box, with a glass cover, suspended by a hair, and made to vibrate, alternately shaded and exposed to the sun, came to rest much sooner in the latter, than in the former, case. That this was not occasioned by an increase of temperature, was proved by the needle vibrating more rapidly, when its temperature was raised by other means.

In repeating this experiment, I very quickly found that it depended, in a great measure, on the nature of the suspension of the needle, and its position with respect to the incident light, what results would be obtained. If the needle was suspended on a point, or by a thread, without torsion, both the time of vibration, and the number of the whole, were the same, whether the needle was exposed to the sun-beam or not. But, if the needle was suspended by a hair, or other organic substance, having torsion, the sun-beam would occasion a degree of twist in the hair, on its first exposure to light; and if the direction of that twist happened to coincide with the direction of the needle's motion, of course the momentum of the needle was increased, and the vibrations continued longer. A needle which vibrated forty-four times in one minute, would occasionally, owing to this cause, vibrate nearly forty-six, when suspended by a hair; but if by a silk

fibre, its vibrations were always forty-four; the first arch of vibration being, in every instance, 40° . That this action was due to a twist of the hair, as a hygrometric body, I ascertained by means of a simple arrangement.

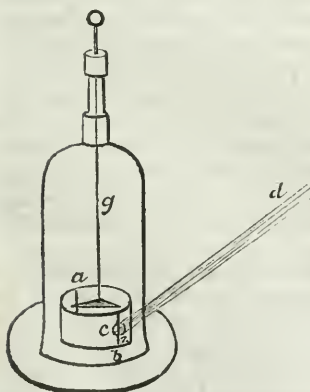


To a brass cross-piece, A, supported on a stand by two pillars, B C, a hair, *e*, was fastened, about the point A; its other extremity, *g*, being fastened to a whalebone spring, D, by a thread, *f*; the extremity, *g*, of the hair, being bent by the knot on one side, served as an index. On exposing the instrument to the sun-beam, the little index, *g*, immediately moved, sometimes more than a semicircle.

Thinking to obtain more decisive effects, I concentrated the sun-beam with a lens, on the south pole of the suspended needle, and found that the needle was thrown into a rapid, tremulous motion. But here the hot air ascending from the needle, acts upon it as upon the sail of a windmill; and the same effect ought to take place, to a certain extent, on simple exposure of the half of a vibrating needle, to direct light. But I found that a needle suspended in the vacuum of an air-pump, by a thread without torsion, is in no way affected by exposure to solar light.

Ex.	Length of needle in inches.	No. of vibr. in shade.	In the sunbeam.
1	$1\frac{1}{2}$ sewing needle	44	44
2	$\frac{2}{2}$ blue spring	32	32
3	$3\frac{1}{8}$ do.	26	26

Therm. in the sun, 109 to 105.—Barom., 29.3.—Duration of Exp., 60'



It is said expressly, in the account of Christie's experiment, that the needle was contained in a brass compass box. It might have been, that electrical currents were excited in that box, which was the cause of the derangement in question; I therefore vibrated a needle, under similar circumstances, with the same result as above stated. I should mention that this was done in a solid cylinder, or ring, of brass, without any seam, or soldered junction; but as compass boxes are generally made of sheet brass, with a soldered seam in the side, it was barely possible that the fine line of solder acted

with the brass, as a thermo-electric couple, capable of excitation by

the warmth of the sun-beam. I therefore made a compound cylinder of copper and zinc, cz , the edges of which, at a and b , were neatly soldered, the junction b being highly polished, and that at a blackened. The needle was suspended in an exhausted receiver, by a silk fibre, g , and a ray of light, cd , coming from an aperture half an inch wide, in the shutter, fell upon the junction. The needle used in this experiment was of watch-spring; its first vibration was performed in an arc of forty degrees, and when the compound cylinder was taken away, it made thirty-two vibrations in sixty seconds, in vacuo. On placing it concentrically with the compound cylinder, and suffering the ray to impinge on the polished junction, the moment that the arch of vibration had become forty degrees, the number of oscillations in one minute was carefully observed; six experiments gave severally the number thirty-two. On turning the blackened junction to the light, the result was still thirty-two; and on substituting the solid brass cylinder, three consecutive trials gave thirty-two. The thermometer stood, in the sun-beam, at 103—the barometer at 28.8.

By some, this magnetic action of light has been attributed to the violet, or more refrangible rays only. A needle made of watch-spring, about four inches long, which, in an exhausted receiver, suspended by a filament of silk, exhibited no polarity, had one-half of it exposed to the violet ray, cast by an equi-angular prism of flint glass. This ray was separated from the others by passing through a slit in a metallic screen, and half the needle shielded from its action by a piece of paper. After two hours' exposure to the sun, it was suspended again in the exhausted receiver, but still showed no token of polarity; it was then exposed to the other rays, successively, with the same result. The needle was now slightly touched, and, slowly vibrating, arranged itself along the magnetic meridian. The first vibration was performed in a semicircular arch, and the number of vibrations performed during one hundred oscillations of a second's pendulum, was 27. But, after four hours' exposure to the violet ray, as before, no evidence of any change, either increasing or diminishing the number of oscillations, could be gained. A column of violet light, passing through a disk of stained glass, was concentrated on one end of a sewing needle, by means of a lens, without producing any change in the number of vibrations it made in one minute. This needle, on some occasions, however, would give uneven results; when its first vibration was performed in a semi-circle, the number varied from forty-one to forty-three, in sixty seconds. On vibrating it in vacuo, its results uniformly gave the latter number, very nearly.

The position of the needle to the incident ray, is not of any consequence; whether it receives it obliquely, in the direction of the light, or across it. If soft iron be substituted for steel, the results are still negative, even if the needle be arranged in the magnetic meridian, the line of dip, or any other position. I therefore come to the conclusion that the violet ray, as developed by a prism of Eng-

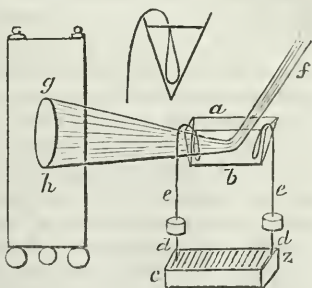
lish flint glass, possesses no influence on the magnetic needle, and all the other rays are equally inert.

But, as Mrs. Somerville found that a needle placed under a piece of glass, or blue ribbon, having half its length protected by paper, became, in a short time, magnetic, I tried the same experiment; but, in every instance, failed in making the needle magnetic. When suspended by a silk fibre, in vacuo, needles showed no disposition to arrange themselves in any particular line, and when they came to rest, they were found cutting the magnetic meridian at every angle, although the temperature of the sun-beam to which they had been exposed, on one occasion, was 124° F. Great care was taken to ascertain the previous non-magnetic state of the needles, and they were suspended by a fibre without torsion. To ascertain whether any thing was due to the nature of the medium, I substituted prisms of water, alcohol, spirit of turpentine, and other essential oils, with the same results.

These are the means by which, it is said, the magnetism of light was first discovered; but there are much more delicate methods of detecting such an action, if it existed, and to them, in the next place, I resorted. For, if the violet, or other rays of light, exercise an influence on the magnetic needle, that action must be mutual between them, and the light, in its turn, should suffer a derangement. To ascertain this, I admitted a divergent beam of light, through a hole in the shutter of a dark room; the cone of luminous matter, at its apex, was about $\frac{1}{10}$ th of an inch in diameter, and a hair, or other filament, held in it, exhibited the phenomena of diffraction, the colours being received into the eye, by a lens. Across this beam, a silver wire was adjusted, each of its extremities connected with cups of mercury, which communicated with the poles of a voltaic battery. It was expected that, if there was any action between a magnetic filament and light, some derangement would be seen in the diffracted fringes, when the current passed; but none such was observable.

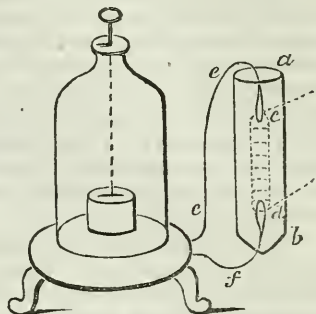
Again, two wires were so adjusted that they could be made to approach or recede from each other, by a screw movement, and voltaic currents be passed in either direction, up or down them, conjointly or separately; when they were within the $\frac{1}{150}$ th part of an inch, the fringes they produced were very perceptible, but the passage of the current caused no alteration whatever. These experiments were also repeated in homogeneous light, with the same results.

A hollow prism, *a b*, for containing transparent, but imperfectly conducting, liquids, was traversed by a voltaic current, from the battery, *c z*, by means of platina wires, *e e*, one extremity of each of which went to the bottom of the liquid, and the other dipped into the mercurial cups of communication, *d d*. A ray of light, *f*,



passed through the prism, and was refracted on the screen, *g l*, or viewed by a glass. Some of those lines which traverse the spectrum, were at times visible; but neither these, nor the spectrum itself, suffered any perceptible alteration during the passage of the current.

Some philosophers have pointed out the different degrees of temperature which Sir W. Herschel detected in different parts of the prismatic spectrum, as analogous to that increase of temperature which takes place in the cells of the voltaic battery, as we proceed from the negative to the positive pole. Hence, they have supposed that each end of the spectrum was in an opposite electrical state. With the analogy I have nothing to do; but to ascertain whether the deduction from it is founded in fact, I made this experiment. I received into a tube, *a b*, filled with acidulated water, the whole of the prismatic spectrum, cast by an equiangular prism of English flint glass, in that



part, *c*, which was covered by the violet ray; I immersed one wire, *e e e*, of a galvanometer, arranging the other wire, *f f*, in that part, *d*, which received the red ray. Alternately placing and withdrawing the arrangement from this position, it was to be expected that either a continuous current, or a wave, of electricity, would pass along the galvanometer wires, producing either a permanent or transient disturbance. I was not able, however, to notice such an effect; and suspecting that, if any electricity was developed, it might be of such low intensity as to be unable to pass through acidulated water, I repeated the experiment, using, instead of the tube of water, a piece of polished tin, in the shape of a parallelogram, three inches long, and one broad, to each end of which the galvanometer wires were soldered; but the results were still negative.

The general termination of these experiments would lead us to suppose that, if there be any reaction between galvanic and magnetic currents, with solar light, they are of such a nature as to forbid repetition in latitudes as far south as 35° . Or, the atmosphere of southern Virginia is too loaded with vapour, and too much obscured with mist, to admit us to distinguish any such effect. But, perhaps, if we carefully consider the nature of light, we may receive much assistance in developing that action which really takes place, when light impinges on all bodies, and hence we may draw an argument to prove that the magnetic action of a ray of the sun, or any other star, is a physical improbability. Now, we usually consider a ray of light to consist of a vast number of particles, of excessive smallness, but, nevertheless, of absolute size, which move with an immense, but measurable velocity. Many arguments might be brought to prove that these particles are non-conductors of electricity, and, perhaps, are the best non-conductors, of any thing we know.

It is an indisputable fact that, whenever one body touches another, the electric equilibrium of the system is disturbed, and as the particles of light obey those laws of attraction at small distances, or capillary action, in common with all other matter, there is no reason that they should depart from a law which bears upon every thing else. I have heretofore shown that capillarity is referable to nothing more than electricity, upon approximation, and that all the phenomena of the former are explicable by the laws of the latter. These considerations lead me to expect that a column of light cannot fall upon the surface of a disk of glass, without a total derangement of the electric equilibrium of the whole system.

[TO BE CONTINUED.]

NOTES OF AN OBSERVER.

Remarks on Professor Olmsted's Theory of the Meteoric Phenomenon of November 12th, 1833, denominated Shooting Stars, with some Queries towards forming a just Theory. By JAMES P. ESPY.

(Continued from p. 16.)

Let us now see if the observations recorded furnish any data, from which we may be able to estimate the height of the meteors. I think they do, and that we shall succeed in showing, with absolute certainty, that, in many places at least, the meteors could not have been ten miles high. If they had been so high, all those observers who were within fifty, or even a hundred, miles of each other, would have seen many meteors in common, and, of course, would have seen the phenomenon commence at the same time, and, also, the radiating point in the same direction.

Such, however, was not the fact in very many instances. At New York, by one o'clock, the discharge was almost incessant, and at two, the whole heaven was streaked with fire,—whereas, in Long Island Sound, the pilot of the steam-boat Providence says he watched the spectacle from its commencement, about three o'clock in the morning, till it disappeared in the light of the sun,—whereas, in Haverstraw Bay, North River; about thirty miles from New York, Capt. Seymour, though he saw an unusual number of shooting stars, principally in the east, about half past twelve, did not notice any surprising splendour in the scene till half past two o'clock—an hour and a half later than it appeared at New York.

But, what is more remarkable still—between these two points, in Tappan Bay, Captain Faurot saw, between *eight and nine o'clock*, as frequently as once a minute, common shooting stars, coursing against the wind, to the south-west by west, or west-south-west. They rose mostly in the north-east, and those which started down in the south-east, were very short. About midnight, the stars became too numerous to be counted, but maintained the same general course, to the west of south-west. Between twelve and one o'clock, the trains were longest and most brilliant—though more numerous afterwards. At West Point, Mr. Twining saw the radiant point only a few degrees

south and east of the zenith, whereas, all the way from Haverstraw Bay to New York, Captain Seymour saw the radiant point not more than forty-five degrees high in the south-east.

These places being near each other, and the phenomena exhibited being so very different, the conclusion forces itself upon us, that the different observers did not see the same meteors, which they must have done, if the meteors had been even ten miles high.

Again, at Boston the meteors fell perpendicularly to the horizon, and at Concord, New Hampshire, they moved from the horizon towards the zenith, and in every other direction. As to the splendid aurora and triumphal arch seen at Dover, N. H., not a word is said of it at Concord; and it certainly was not seen at Boston, unless it was there in the form of a "vapour round the horizon, which, in the south-east, assumed a very beautiful appearance during ten minutes, half an hour before sunrise." Now, as Dover is not more than sixty miles from Boston, this auroral arch could not be more than two miles high, or it would have been seen several degrees above the horizon there. And as it is not mentioned as having been seen at Concord, twenty-five miles from Dover, the probability is, that it was not, and if so, its height must be diminished down to less than a mile. Again, the beautiful appearance seen at Boston, in the south-east, could not have been fifty miles from Boston, or it would have been nearer Providence than Boston; but Professor Caswell says no auroral appearance was seen at Providence. And, what is more worthy of remark still, is, that the remarkably bright auroral light seen by Mr. Palmer, at New Haven, constantly in the east, as high as seven or eight degrees, was not seen at Providence at all, which it must have been, very distinctly, if it had been two miles high. Again, at Matanzas, Cuba, the meteors fell perpendicularly, and at the distance of less than forty miles out at sea, lat. $23\frac{1}{2}$, long. 32, the ship Tennessee was in view of the meteors on every side, from four to six o'clock. *They seemed to follow the direction of the wind, which was east-north-east.*

These observers could not have seen the same meteors which they would have done if the meteors had been ten, or even five, miles high.

At sea, off Charleston, S. C., the meteors commenced at nine o'clock; whereas Captain Parker, of the ship Junior, on the west side of Florida, who was observing, at a little before three o'clock, saw several meteors, but *not more* than he had often seen before; but about three, the number increased so rapidly, that he could not count them. Nor is there any regularity in the time of beginning. At Union Town, Pa., the meteors were but few at half past four, but rapidly increased till five; and at Poland, Ohio, the maximum was from two to three, or two hours before they appeared at all at Union Town. Off Charleston, S. C., and in the North River, they appeared more than seven hours before they appeared at Union Town.

At St. Augustine, about half way between Charleston and the ship Junior, the meteors commenced about four and a half hours after their commencement near Charleston, at sea, and about half an hour

before they appeared to Captain Parker. It will be interesting to compare a few of the phenomena as they were seen by Captain Parker, on the west of Florida, and by Captain G. S. Drane, at St. Augustine, about 260 or 280 miles apart, from which I think it will appear that nothing was seen in common.

Captain Drane's account, with others at various military stations in the United States, has been kindly furnished to me by Professor A. D. Bache, of the University of Pennsylvania. At St. Augustine, the meteors were equal on all sides, falling nearly perpendicularly to the horizon, from a point a few degrees north-east of the zenith. To Captain Parker they all appeared in the north-east, not one more than forty-five degrees high; at least till half past four o'clock, when some began to pass to the south-west. At St. Augustine, it was perfectly clear and calm—to Captain Parker there appeared heavy dark clouds, hanging low, in the north-east, exactly towards St. Augustine, from which the Second Mate saw the first meteors break like lightning, and there was a light wind from the cloud.

At St. Augustine the colour of the meteors to the west was white, those to the east were tinged with the rosy hues which precede the rising of the sun;—to Captain Parker no prismatic colours were visible.

Captain Parker says, though all the meteors, both great and small, left luminous traces, no one of these traces was observed to continue visible more than two seconds;—whereas at St. Augustine, when the meteors were falling in their greatest numbers and brilliancy—at the very time when the mate was watching the phenomenon with intense interest—a vivid flash of light burst suddenly from the point where the meteors emanated, and, winding its course slowly along, assumed the fantastic shapes of 5 and 2. During fifteen or twenty minutes, this luminous spot continued to be visible, gradually spreading, and diminishing in intensity, until it was confounded and lost in the bright azure of the sky. Now this cloud, which, in all probability, was connected with the meteors which were seen to dart from it in all directions like lightning, could not have been four miles high, or it would have been several degrees above the horizon at St. Augustine, and so careful an observer as Captain Drane, could not then have described the atmosphere as “very clear, and entirely free from clouds.”

There is another circumstance which renders it extremely probable that the meteors were not more than two or three miles high, and that is the angular velocity of the luminous clouds formed by the trains which they left in their passage through the air. The Professor himself seemed to be aware of the force of this circumstance; for after calculating the height of one meteor, supposed to have been seen by himself and Mr. Tomlinson, to be thirty miles at the moment of its explosion, or nearest approach to the earth, he says, “the cloud moved eastward with a very perceptible progress, equal to that of an ordinary cloud a mile high, carried by a breeze of ten miles an hour. But, in order to move with such an apparent angular velocity at the height of thirty miles, it must have had a real motion of

300 miles per hour." He might have added, also, that the upper part of the train must have had a velocity of more than 600 miles per hour. But he goes on to observe that "the improbability of such a velocity would lead us to believe that the place of explosion was comparatively near the earth."

I would add to the Professor's remark, that it is highly improbable that the same meteor was seen by the Professor and by Mr. Tomlinson; for the Professor's "meteor was seen fifteen minutes before six, and Mr. Tomlinson's thirty minutes before six, or a few minutes more or less."

I will add here, also, that it is highly improbable, if not absolutely impossible, that the meteor seen by Mr. Tomlinson, and that seen by Captain Seymour, was the same.

The observations of these two gentlemen, being supposed to belong to the same meteor, are used, with others, to calculate the height of the meteors, by Mr. Twining. Now, Capt. Seymour, with watch in hand, observed the train to continue straight for four minutes—whereas the train of the meteor seen by Mr. Tomlinson retained its rectilinear form but a few seconds. In the course of a minute—others think as many as three or four minutes—it had assumed shapes like the figures 2, 3, 4, and 5. As this description cannot possibly apply to the other, it is highly probable that the meteor seen by the one was not seen by the other, for they were both looking at the heavens at the same time, and if so, it forms a strong presumption that the meteors were very low, not five miles high.

But if the meteors were really low at the time of extinction, to which opinion the Professor seems strongly to incline, and for which I have yet an indubitable proof to adduce, there is one conclusion of which he did not seem to be aware, and that is, the upper extremities of the meteor's visible path was comparatively low also. And this is incompatible with the Professor's theory; for a light body could not fall far into the atmosphere with the velocity of the meteors, without producing ignition, if it produced it at all by condensation of the air.

To conclude the evidence on this point, I assert, that those meteors which were heard to make a cracking, or whizzing, noise, or a noise like a pop-gun, or like birds flying through the air, or like the explosion of loose gunpowder, could not have been many hundred yards from the observer—certainly not half a mile. Now, the evidence that such noises were heard, cannot be doubted by any one unbiased by theory. Who could doubt, if there had been no other witness, than so patient and minute an observer as Mr. Palmer? could he be mistaken on this point?

"He heard, at different times, a number of slight explosions, which usually resembled the noise of a child's pop-gun and was not unlike that of a fire-rocket. They were followed by a peculiar odour, observed by all the company, (four men) which one compared to the smell of sulphur, and another to that of onions. The meteors which afforded these sounds, all passed along in a north-west direction.

"They severally afforded so much light, that Mr. Palmer could distinguish the colour of a man's beard. They passed below the tops

of the trees, at the distance of twenty-five rods from the place where he stood, giving a pop just before they reached the trees. One appeared to strike the barn, and gave a louder pop than any of the others."

We may remark on the account here given, that Mr. Palmer was most undoubtedly under the impression, at the time of observation, that the sounds which he heard, corresponded with the distances at which he then supposed the meteors to be from him. Indeed, so intelligent an observer must have formed his idea of their distance, more from the length of time which the sound took to reach his ear, than from sight, which is liable to be deceived. This circumstance alone, I think absolutely decisive of the great proximity of those meteors, at least, which were heard by Mr. Palmer.

It may be asked, why did not all hear noises who listened for them in silent situations? The answer is easy: Mr. Palmer, and those with him, heard only a few, and all *those* made that kind of sound which is never heard many hundred yards—and in nine places out of ten, the meteors might not have approached near enough to the surface of the earth, for such sounds to be heard; and even if they did, not one out of a thousand might happen to be sufficiently near the observer. And yet sounds were heard at a very considerable number of places—at New Haven, New Britain, New York, Richmond, Charleston, S. C., St. Marie, Mo. Ter., Fort Jackson, Lou., Fort Leavenworth, Ark. Ter., Fort Oglethorpe, Geo., Fort Moultrie, S. C., and Fort Jesup, Lou. At all these places, with the exception of Charleston and Fort Moultrie, just such a sound is described as could not be heard many hundred yards.

Off Charleston, a meteor of extraordinary size, was observed at sea, to course the heavens for a great length of time, and there explode with the noise of a cannon. At Fort Moultrie, some of the noises were hissing, some like the discharge of a musket, and one as loud as a six pounder. Now, who can say, in our present state of ignorance of the cause and nature of these meteors, that even these extraordinary and insulated cases are either impossible or incredible?

At all events, the evidence of a hissing noise is too respectable to be doubted; and this settles the question of their very near proximity to the surface of the earth at the time of explosion; and, for reasons assigned above, proves positively their atmospheric origin. These two positions, then, I hope I may be permitted to say, have been established—that the meteors were not gravitating bodies, falling towards the earth by the force of gravitation—(not even those which fell perpendicularly, much less those which moved horizontally)—and secondly, that they were of atmospheric origin. I hope it will be considered a matter of some importance to have these two points established, and not merely conjectured. For, the mind being freed from wild speculations and visionary theories, as to their *celestial* or *volcanic* origin, will be left at liberty to seek for their true cause in the atmosphere, where they undoubtedly take their rise.

And here I cannot avoid repeating what I hinted at before, that many circumstances render it highly probable that the meteors in

question, and the aurora borealis, have one common origin. They have both now been demonstrated to be low in the atmosphere, (see Journal of the Franklin Institute, vol. xiii. p. 294)—they are both frequently attended with hissing or snapping sounds*—there are very often a great many *meteors* on nights of aurora—and on the night of these meteors there were a great many auroras. Indeed, I would suggest that many of the auroral appearances which were exhibited that night, were these very meteors themselves. The bank of auroral light, resembling day-break, which was observed by Mr. Palmer at New Haven, and the vapour in the atmosphere, visible round the horizon at Boston, which assumed a very beautiful appearance in the south-east, an hour before sunrise—might be the meteors themselves, too far off for any one to be distinctly visible, and yet, by their combined influence, producing a luminous appearance. So the auroral or boreal light, which appeared at Cincinnati a little north of east, the lower edge of which was several degrees above the horizon, was possibly owing to the same cause.

Once more, the twilight which was seen by Mr. Twining at West Point, between five and six o'clock, issuing from the whole south-eastern and southern, while the western and northern quarters were as dark as usual—might depend on the difference in the number of meteors which fell in those different directions. This fact might, perhaps, be yet ascertained.

Finally, on this point, the difficulty is, that luminous appearances were not exhibited at all places where the individual meteors were not seen to approach to the earth nearer than fifteen or twenty degrees; for remote meteors certainly did fall lower than that, and though their light might not be strong enough to make a distinct impression of their individuality through so great an extent of atmosphere, yet it would seem that their combined influence should have been sufficient to produce a sensible illumination. Perhaps this illumination was too faint in most cases, in comparison with the splendour above, to attract particular notice, even where it actually existed. Accordingly, we find that it was sometimes mentioned incidentally, as if unworthy of particular remark, as when the observer says at Richmond, "they appeared to be extinguished in an azure belt that encircled the horizon." Two facts highly interesting in themselves, and not altogether unconnected with the atmospheric origin of the meteors, may be mentioned here, as they have not been yet published.

At Fort Gibson, General Arbuckle, after describing the phenomenon as a shower of fire, consisting of innumerable meteors, many of which were more than fifty times the usual size, and as being so bright that every thing could be seen almost as distinctly as in daylight, goes on to say, that *this brilliant display at no time continued more than two or three minutes at once, when night resumed its usual darkness, for about thirty or forty seconds, and in this order of succession, was*

* See Silliman's Journal, vol. 14, and Jour. of Frank. Inst. vol. 13, p. 366,

this grand exhibition witnessed from its commencement, fifteen or twenty minutes after three o'clock, until daylight.

I would here observe, that there is a remarkable similarity in the facts here described, to what Professor Bache and I frequently saw last August, when we were watching for meteors simultaneously, on many different nights, at the distance of four miles apart, for the purpose of ascertaining their height; we frequently noticed, that after an interval of many minutes, two or three sometimes, four meteors would appear in rapid succession. With us, however, there was this difference—that immediately after one meteor terminated, another would start from a point near its termination, and shoot off, sometimes at right angles to the path of the previous one, and only in one instance was the latter seen to continue in the same straight line with the former.

The other most remarkable fact which I wish to mention here, is, that at one or two of the military posts far west, *all* the meteors moved horizontally. This will clearly appear from the following facts, when it is considered that if either the point from which they diverged, or the point to which they converged, was in the horizon, according to the laws of perspective, their motions must have been horizontal.

Captain John Stuart, of Fort Smith, gives the following statements of a Sergeant, who, the Captain says, is a very intelligent man, and a sentinel at the guard house.

The Sergeant says, that about one o'clock, the sentinel called him, and told him to look at the stars, which were all falling to the ground. This sentinel says, that the first of the extraordinary appearances which he witnessed, was, that a great number of stars came over him from the south-east, and, as he thought, fell in the woods about a quarter of a mile from him, towards the north-west, which was instantly followed by a cloud of stars, covering nearly the whole heavens, and which appeared mostly to fall to the ground, or disappear in the north-western horizon, at various distances from him. The Sergeant further says, that when he came out of the guard house, the whole heavens appeared to be thickly covered with stars, moving with great velocity from the south-east to the north-west, and tending, at the same time, downward, insomuch as to appear to drop into the woods, at a short distance, or were lost sight of in the north-western horizon. The meteors appeared to him to vary in size, from that of the largest star in the heavens to about twice that size. This appearance continued without intermission from about one o'clock till daylight. Neither of these observers recollects to have seen any of these meteors drop or disappear to the south-east of the zenith. Another sentinel, posted on the river, and who had a view of it for two or three miles, said, that they appeared to him to resemble more falling in large lumps, and that they fell all over the river, and in the woods beyond. Another said, that they appeared to him to resemble clouds of birds, which came from all directions, and concentrated in a lake about a mile north-west of the fort, where he supposed that the most of the stars he had seen during the night, had fallen. Another one said, they appeared to concentrate in the north-west. *One*

thinks they sometimes crossed each other's paths in approaching the north-west.

Here is a mass of evidence, perfectly satisfactory, from plain, unlettered men, not proving, indeed, what they all believed, that the meteors fell to the ground a short distance from them to the north-west, but that *their motions were horizontal*.

How could these meteors have had a celestial origin? Or, if they had, how does their radiant, which was in the south-eastern horizon, agree with Mr. Olmsted's?

(*To be continued.*)

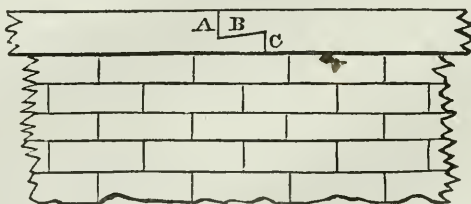
Expansion and Contraction of Coping Stones.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—The tenth volume of the Journal of the Franklin Institute contains the description of a joint for coping stones, which is stated by the writer to have been found sufficient to protect walls from drip at the joints. The form is figured in the annexed cut, in which A and C are the vertical portions of the joint, and B is a slope connecting them, intended to prevent the water which passes in at A, from obtaining access to the wall at C. This joint is stated to require no cement. It seems to me that such a joint, with or without cement, must prove wholly ineffectual. If the joint be without cement, and as closely fitted at A, B, and C, as the nature of the material will admit, there will be formed very small clefts, through which water will be drawn by capillary action, and will reach the mortar of the wall on which the coping stone is laid. If the joint be made open, to avoid this, the head of the water will enable it to surmount the slope B. If the joint be closed by mortar, the alternate expansion and contraction of the stones will work the mortar loose, and form capillary clefts, similar to those of which I have before spoken. These effects may not render themselves visible at once, but in time must destroy the structure which the coping should protect.

Yours,

R. L.



FRANKLIN INSTITUTE.

Monthly Conversation Meeting.

The third conversation meeting of the Institute, for the season, was held at their Hall, Nov. 27th, 1834.

Mr. Thomas Ellicott, of Philadelphia, explained a weighing ma-

chine, and, by reference to a model, a weigh-lock for canal boats, invented by himself; the arrangement of which was judged to be well adapted to the purpose.

A weighing machine, by E. & T. Fairbanks, of St. Johnsbury Plains, Vermont, attracted much attention, and the facility and nicety of its operation were tested and approved.

Messrs. Carr & Lunt exhibited specimens of chisels and butchers' knives, manufactured by I. Russel & Co., of Greenfield, Massachusetts; these were well finished, of approved shapes, and of good quality.

Messrs. Curtis & Hand exhibited a model and specimen of a spring latch for doors, invented by Messrs. Blake, Brothers, New Haven, Conn.; which was admired for its simplicity and apparent durability.

Specimens of rolled sheet-iron handles, for buckets, manufactured by Messrs. Sergeant & Bashford, of Brooklyn, New York, were exhibited; these handles were considered an improvement upon the kind heretofore in use.

Prof. Johnson exhibited and explained models illustrative of the action of the eye, of its parts, and of the mode of vision.

Prof. A. D. Bache gave the particulars of the eclipse of the sun, predicted for the 30th of November, and stated the preparations which had been made, in this city and its vicinity, for observing it.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN JULY, 1834.

With Remarks and Exemplifications, by the Editor.

1. For a *Saw for sawing Staves for Barrels, &c.*; Aaron Bard, and Simeon Heywood, Lunenburg, Worcester county, Massachusetts, July 8.

The saw described is to be in the form of a hoop, made of a diameter corresponding with that of the vessel, to the making of which the staves are to be applied. This hoop saw is to be sustained in its place by a number of rollers fixed in a suitable frame. We think it unnecessary to notice the various appendages which are mentioned, as a machine perfectly similar, and which was patented on the 29th of August, 1833, by Sumner King, of the state of New York, has been described by us at p. 121, of vol. xiii.

2. For a *Machine for Picking Curled Hair*; John Thompson, 3d, Marblehead, Essex county, Massachusetts, July 8.

(See specification.)

3. For improvements in the *Crane used for raising and removing heavy bodies*; Hezekiah Bradford, city of New York, July 8.

This crane is principally intended for raising and removing the earth, or other bodies, in excavating the ground for canals and railroads, and it is so constructed that the boom which sustains the load can be made to raise it to a considerable height, and deposit it upon



a bank, in any spot required. The boom is rigged to a mast, and the respective motions are produced through the intervention of tackle. The arrangements have been made with much skill, and, so far as a judgment can be formed from the evidence before us, we see no reason why the apparatus should not operate in a very advantageous manner. The whole description has reference to the drawings which accompany it, and these, indeed, seem absolutely necessary to the understanding of its details.

It is stated that, "by the use of the above machine, a horse, or other animal, and one driver, will accomplish the removal and deposit of a greater quantity of coals, or other heavy bodies, from one spot to another, or to and from a wharf, barge, scow, or other vessel; or remove and deposit in the same manner, from excavations, or in other similar work, a large quantity of earth, or other heavy materials."

"By the arrangements for altering the rake of the mast, I with facility cause the weight that is raised to swing round whilst in the act of raising, and to be carried to the place where it is to be deposited, governing the motion thereof so as to make it more or less rapid, by merely changing the rake of the mast, and the position of the snatch block, so that it shall be further from, or nearer to, the mast. I cause the emptying of the load, or the *dumping*, as it is called by the workmen, to be effected by the same power which raised it, and at the moment at which it arrives at its place of destination."

"I do not claim as my invention, or improvement, the introduction of the use of a crane, or boom, for the purpose of raising and removing heavy bodies; nor do I claim as my invention, or improvement, any of the several parts of the above machine. But I claim as my invention and improvement, the combination in all its substantial parts, and the above described new arrangement and adjustment of the parts of said machine to each other, in such a manner as to produce the above results, when applied to the purposes above specified."

4. For a *Portable Furnace*; John Lewis, Derby, New Haven county, Connecticut, July 8.

This furnace is of the kind intended for domestic use, and it is to be composed entirely of metal. There are to be four concentric cylinders, the innermost of which is to be of cast iron, with a grate at bottom to sustain the fuel. The other cylinders are to be of sheet iron, and are to have a space between them of half an inch. The outer cylinders are to rise above the inner one, and are also to extend below it. The cylinders are to be kept in their places by screw bolts passing through them, having their heads within the inner, and nuts against the outer, cylinder. These bolts may also pass through pieces, which form feet to the furnace, and the heads of the lower ones may serve to sustain the grate. The patentee claims as his "invention, the construction of a portable furnace, by a combination of cylinders and air chambers, adapted to each other, arranged, and connected, as in this specification is set forth. And I do not claim

any part of the whole instrument, separately taken, or the mode of forming the separate parts, or the use of cylinders or air chambers in general, but only their use and application in the construction of a furnace, as above specified, described, and claimed."

5. For a *Cotton Whipping Machine*; Samuel P. Mason, Killingly, Windham county, Connecticut, July 8.

The patentee has described this machine entirely by references to the drawings, without putting in any claim to novelty, or designating, in any manner, the difference between it and other whipping, or beating, machines. It operates by means of two horizontal shafts, furnished with fingers, or projecting pins, which play between each other, those passing through one, coming nearly into contact with the other, shaft. There are also some stationary pins, or fingers, attached to the box in which the shafts revolve, serving to aid them in their operation.

6. For an improvement in the *Construction of Hatters', or other, Kettles*; William Porter, and Abraham Sanger, Waltham, Middlesex county, Connecticut, July 8.

The object of the improvement described is to expose a larger surface to the action of the fire, than is exposed in the way in which such kettles are usually made. The ordinary kettle, which is made conical, is to be surrounded by an annular, or ring-like, vessel, which opens into it below the surface of the contained liquid. The flame is made to play between the conical and the cylindrical parts of the kettle, and around the latter, before it finds its way into the exit flue. The claim is to "the construction of a kettle, or boiler, with different compartments, or flues, as herein described, for the purposes above mentioned."

It would, perhaps, have been more safe to have confined the claim to the particular construction of hatters' kettles, as given in the specification, as there are boilers for steam engines in which the fire operates between concentric cylinders, or vessels of other forms, in a manner very analogous to the foregoing.

7. For an improvement in the *Fireplace*; Horace Saxton, Erie county, New York, July 8.

This fireplace, or stove, is somewhat in the form of, and is set like, the Franklin stove. The draft, instead of passing through a throat, in the usual way, passes through several holes in the upper back plate; and behind this plate there is an oven, around which the flue passes; there are also holes in the top plate, for cooking utensils. The patentee states that the following constitute his improvements:

"Adding three tiers of holes to the back, to cause a draft for fire and smoke to pass quickly through.—Joining or adding an oven to the fireplace on the upper part of the back side, to be heated from the fire as it passes through holes around it.—Adding the two holes, with

rim, on the top plate, for boilers, or kettles, to be set in. Which improvements only I claim as my invention."

Perhaps the holes in the back plate may be new; but, if so, we do not think them any improvement, as the draft would pass equally well, and probably better, through a narrow throat. The other two points claimed, are mere matters of arrangement, not differing essentially from what has been repeatedly done.

8. For a *Horizontal Straw and Vegetable Cutter*; Paul Moody, city of Philadelphia, July 8.

The straw, or vegetables, to be cut, are placed in a box, or hopper, in which they descend by their own gravity, so as to come into contact with a revolving blade, extending from the centre to the periphery of a horizontal wheel. The patentee says, "I am aware that simply a wheel, with one or more knives, or cutters, screwed on the arms, in a machine for cutting straw, is no new thing. *But the peculiar* construction of the above described box wheel in a machine for cutting straw, hay, &c. &c., which, with its regulating bottom, or gauge; the mode of fastening the knife and slitters to it, with the application of the latter in the machine to cut vegetables square; and also the apparatus above described for forcing down and compressing hay, straw, &c. &c., is what I claim as my invention and improvement."

Machines similar in principle have been previously patented and described by us; the claim, therefore, should be only for what are called improvements, the general construction belonging to the original inventor, and not being usable without his consent.

9. For a *Hammer Hatchet*; Joel Howe, Princeton, Worcester county, Massachusetts, July 8.

If to the hammer part of a shingling hatchet, you add a claw projecting back from the hammer face, in a line with the handle, you have this machine.

"The operation of drawing nails is performed by lifting the handle. The hammer drives like other nail hammers.—The invention claimed consists in the combination of the hammer claw with the hatchet, and hammer head and face."

10. For a *Plough*; James Jacobs, Maysville, Mason county, Kentucky, July 8.

The description of this plough is given, with the precise measurements of the various parts, and with references to lines laid down in the drawings, for the purpose of showing and explaining that particular shape of the mould board, and other parts, which the patentee thinks best adapted to the separation of the furrow slice; and the claim made is to a plough constructed exactly upon the principles described. A description and claim of this kind do not fulfil the requirement of the patent law, that the inventor should distinguish his invention from all things before known or used.

11. For a *Plough*; James Jacobs, Maysville, Mason county, Kentucky, July 8.

This the patentee denominates the "Smeller Plough," and says, "My claim is particularly laid for the formation of my mould board, according to the several lines described on the face thereof, which, by the assistance of the several perpendiculars let fall from them, give those parts of circles, or segments, by or according to the courses of which, the various concavities and convexities of my said board are formed. I also claim the formation of the head and neck, as giving it the advantage of being cast in one piece, with the rest of the mould board, at one operation, without the necessity of a pattern made in two pieces; and more particularly because it allows the holes for the front bolt, and for the brace likewise, to be cast at the same time with the rest."

The casting of the head and neck in one piece with the mould board, is a common practice; the other claims are indefinite.

12. For a *Filtering Apparatus*; Littleton Ayres, city of Baltimore, July 8.

Water is to be filtered in this apparatus by passing it upwards, by means of hydrostatic pressure, through sponge, charcoal, sand, or other suitable materials; and the claim made is to "the application of hydrostatic balance, or percolation from below, by means of a superior source, either natural or artificial, in combination with gravitation."

Not only has water for domestic use, but rivers for the supply of cities, have also been filtered by "percolation from below, by means of a superior source." A volume might be furnished, by collecting together what has appeared on this subject in the different journals devoted to science and the useful arts. There are three articles in one volume of this journal, either of which will serve to show that there is nothing new in the proposition of the patentee, as, in each of them, the filtering of water by pressing it upwards is the leading principle. We refer to vol. iv., pages 39, 221, and 370.

13. For a *Self-balancing Slide Valve for Steam Engines*; John Kirkpatrick, city of Baltimore, July 10.

(See specification, p. 203, vol. xiv.)

14. For an improvement on *Bushing the Sheaves of Pulleys*, and on their pins; Moses H. Marshall, Gloucester, Essex county, Massachusetts, July 10.

Wrought cast steel, of a low temper, is to be substituted for the materials heretofore used for the bush and pin; and in wooden sheaves, strong iron plates are to be let in on each side, and firmly riveted about midway between the centre and rim; these bear against the steel bush which passes through the sheave, and keep it firmly in its place.

15. For a *Traverse Sleigh*; Bela Markham, Burlington, Chittenden county, Vermont, July 10.

The term traverse sleigh is new to us, although, from the tenor of the specification, it seems to be familiarly used in the part of the country where the patentee resides. Judging from the drawing, it appears to be a kind of double sleigh, intended for the carrying of country produce, in situations where a large portion of such articles waits for transportation until the arrival of the sleighing season. The platform, or bed, has under it two sets of runners, which, we suppose, is the usual construction, the things claimed appertaining to other parts of the structure; these we shall not attempt to explain, as we should be compelled to allow more space to the article than would be generally approved.

16. For a *Thrashing Machine*; Amos and John Wright, Fredricksburgh, Spottsylvania county, Virginia, July 10.

In this machine, the claim is to the combination and arrangement of the several parts; which combination and arrangement differ so little from the same things in many other cylinder and concave thrashing machines, as to render it impossible to point out what is new in them, the patentees having themselves left us in the dark on this subject.

17. For an improvement in *Railway Carriages*; Isaac Knight, city of Baltimore. First patented March 18th, 1829; patent surrendered, and reissued upon an amended specification, July 10.

We published the specification of this patent at p. 411 of the last volume, and will here remark, that the point embraced in the present specification was one among several contained in that which was surrendered, the others being deemed invalid, or unimportant.

The same mode of sustaining the lateral thrust of the axle which forms the claim of Mr. Knight, was also claimed in one of the patents obtained by Mr. Ross Winans; which of these gentlemen was "the true and original inventor," is not a question for us to determine.

18. For an improvement in the employment of *Water Power*; Ebenezer Barford, Jay, Oxford county, Maine, July 10.

"The specific, new, and superior facilities comprised in the above described improvement, and which I claim as my own invention, are the following: 1st. The construction of the tub wheel; its peculiar location, being immersed in a reservoir or cistern of water, and consequently not liable to be encumbered with ice; and the manner of its operation, as comprising the wedge power. 2d. The peculiar manner of using the water, so as to double its action upon the terminating wheel, with its full primary force in each action. 3d. The general arrangement and combination of the parts, without specially regarding their size or proportions, or the material of which they are constructed."

Those persons who are well acquainted with hydraulics, will see

enough in the foregoing claims to convince them that the inventor has "travelled out of the record." The idea, which is clearly expressed, that the same water, in the same fall, may be twice used, "with the full primary force in each action," is so manifestly fallacious, as not to require to be disproved; if it can be twice used "with the full primary force," it may be so used a hundred times, and a fall of four feet would be as available as one of four hundred.

In the plan before us, a wheel, with spiral openings near its periphery, through which the water is to descend, is to be placed horizontally in a trunk, or flume; and after it has descended through this, it is to be conducted to an undershot, or flutter, wheel; and the shafts of the two wheels are to be connected by straps, or gearing.

19. For a *Steam Bug Destroyer*; Jonathan Howlet, Greensboro', Guilford county, North Carolina, July 10.

Woe to the bed-bugs, should these steam bug destroying machines become as numerous as washing, thrashing, and churning machines, of which there seems to be some danger. This is the second from North Carolina, a state by no means prolific in patented inventions. In vol. xiii., p. 313, we described one from the state of New York, and, not long since, there was one from the far west; and, what is somewhat curious, they are all alike, and are also all of them similar to such as had been previously described in the English journals. As the bugs are doomed to destruction, it might be some consolation to them in their dying agonies, to know that their enemies will not be able to sustain the right which they claim to their "infernal machines," under the patent laws, the great seal to the contrary, notwithstanding.

20. For *Propelling Wheels*; William Kelly, city of Pittsburgh, Pennsylvania, July 10.

Upon the ends of the arms of a paddle wheel, in the place usually occupied by fixed buckets, there are to be quadrangular frames, like the four sides of a box without top or bottom, two sides of which are to act as paddles; these frames are to swing upon pins between the arms, and, it is said, "so long as the frames are in the water, they are held in a position parallel with the surface of the water, by its action on the paddles; and when the frame and buckets leave the water, they are held in the position they are then in, by a guide, or stop, placed on each of the arms, on both sides," &c.

We think but lightly of any of the plans for causing the buckets of paddle wheels to enter and leave the water vertically, or nearly so, as the best of them appear to us to be of doubtful utility; at all events, the best which have been tried, have disappointed the expectations formed of them by their projectors; that now proposed differs from its predecessors, but what advantages it has over them, we are altogether at a loss even to guess.

21. For propelling machinery by *Horse Power*; Eliakim Briggs, Fort Covington, Franklin county, New York, July 12.

This is the common, inclined, movable floor, upon which the horse is to walk. The cross slats are to be connected together by staples and links on their under sides, which, by their bearing against each other, as the floor becomes straight, are to sustain it, with the horse, or horses, upon it. The doing this by means of the staples and links, is the part claimed as an improvement. There are at least two existing patents for sustaining such a floor, without ways between the drums at the ends; in both these instances, however, blocks, or stops, attached to, and rising to some height above, the upper sides of the slats, were to be brought into contact by the straightening of the floor. This latter method is undoubtedly preferable to that designated in the foregoing patent, but neither of them can be safely depended upon, with the weight of a horse upon the floor, as it is subjected to a leverage which will, sooner or later, cause them to fail.

22. For a *Chain of Boats*, for inland navigation; Gurdon F. Saltonstall, Darlington district, South Carolina, July 12.

As the title indicates, these boats are to be so constructed that two, three, or more, may be linked together. Those forming the two ends present a sharp bow to the water, whilst the joining ends terminate abruptly, so that, when brought together, and linked, they form one continuous boat. The specification points out the advantages to be derived from boats thus constructed, and the patentee manifestly supposes that the idea of thus connecting boats is altogether new; in this, however, he is mistaken, as will presently appear. He, in fact, seems to think that the whole arrangement proposed by him is original, as he does not make any claim, or attempt to point out in what respect the invention is to be considered as new.

In vol. xii., p. 235, canal boats are described, for which a patent was obtained, April 6th, 1833. Six, or any other number of, sections were to be joined together, the two end sections being so formed as to cause them to pass readily through the water, the others being square, to admit of their being conveniently linked together, just as in the case before us. It is scarcely necessary to go further back, in order to prove the truth of the assertion above made.

23. For a *Machine for Drawing Boots*; Lewis Dole, and Nathaniel Peckard, Bowley, Essex county, Massachusetts, July 12.

The patentees describe a machine, by means of which the leather, held by proper pincers, is to be drawn with great power over a boot former. There is no claim made, and it is to be presumed, therefore, that the whole contrivance is considered as new. We have described several machines for the same purpose, and were we to add this to the number, we must either procure a cut, or write a page; we therefore proceed to other matters.

24. For *Locks for Doors*; Simon Pettes, Bellows Falls, Windham county, Vermont, July 12.

The door lock for which this patent is obtained resembles, in several particulars, some which have been previously made the subjects of patents. The bolt and its appendages are not attached to a plate, as in ordinary locks, but are let directly into the door. A hole is to be bored into the edge of the style, to the depth of four or five inches, to receive the bolt, on the end of which there is to be a spiral spring, to force it forward. A slot, or mortise, is to be made in the bolt, at about its middle, and through this the shaft of the knobs is to pass, the slot allowing the bolt to move backwards and forwards. There is a cam, or tumbler, on the shaft, that acts against shoulders in the bolt, which are formed by reducing its thickness at that part. The door is bored through to insert the cam, and other parts; and the opening, thus made, is to be covered, on each side of the door, with brass plates. So far, the operation is only that of a spring bolt, but, in order to give it the effect of a lock, there is a kind of elbow, or bent lever, one end of which is to be operated upon by a key, thus causing the other end to catch against the front shoulder in the bolt, which prevents its being retracted by the knobs. The arrangements made for producing these results, do not appear to be any better than some which have preceded them, neither as regards security, nor simplicity. Without a more particular description of the individual parts, the claims made cannot be perfectly understood; some of them we think rather trifling; they are as follows:

“My claim is to the bolt as above described, and to the manner of moving it backwards and forwards by means of the circular plates; also to the elbow, and the manner of using it to check or secure the bolt when thus locked; likewise to the groove in the shaft, by means of which the handle can move up or down the screw shaft; and to the application of the spiral spring to the end of the long arm, thereby confining it in its situation.”

25. For an improved *Cider Mill*; Nathan Booth, Cheshire, New Haven county, Connecticut, July 12.

This cider mill is to be made in the form of the old-fashioned coffee, or bark mill, with a conical nut, and a shell adapted to it, both of which are to be made of wood, the grooves or spirals upon them being formed by bars of iron fixed upon each, at an angle of about forty-five degrees. These bars are to be an inch wide, and half an inch thick; they are to project their whole thickness at the upper, or feeding, end, but are to be let into the nut and shell, so that, at their lower ends, they shall not rise more than a sixteenth of an inch. The wood between them, at the upper ends, is to be grooved out, so as readily to admit the apples.

The patentee says, “As the basis of my improvement and invention is the old and well known box coffee mill, I claim only as my invention, the use of iron bars to arm wooden cylinders and shells of proper size, with suitable teeth and fluting, to form a strong and durable surface, peculiarly adapted to grinding apples for cider, in the manner above specified.”

It would seem to us that a cast-iron nut and shell would be more

strong and durable than that described; and we also think that it could be made at less cost than one of wood, with wrought iron ribs, or flutes.

Against the evidence of experience, we have not a word to urge; but, without the aid of this, we should be apprehensive that the pomage would not readily find its way through the mill, if set so close as is proposed; this, however, does not affect the patent, as the openings may, of course, be made of any required size.

26. For an improvement in the mode of manufacturing of *Plates for Gun Barrels*; Harvey Mills, Springfield, Hampden county, Massachusetts, July 12.

The plates are to be prepared for welding, by rolling, instead of by forging, as has been usually done. The rollers are to be somewhat more in circumference than the length of the barrel to be formed, and are to be geared together in the ordinary way.

Flat bars are to be employed, of about three-fourths of an inch thick, and wide enough to form the butt of the plate by rolling longitudinally; and in order to give the taper required, both in width and thickness, the bar is first rolled edgewise through eccentric grooves, wide enough to receive it, and is thus reduced to the proper width. It is then rolled flatwise through another groove, or grooves, so formed as to give it the required thickness at the butt, the muzzle, and the intermediate parts. The scarfing is performed in the same way, in suitable grooves, as is likewise the grooving by which it is finally prepared for welding.

The mode of proceeding so as to commence the operation upon each bar at the proper moment, is fully described, and the subjoined claim is then made.

“What I claim as my invention or improvement, is the above described method and process of manufacturing plates for gun barrels, and the manner of engaging and disengaging the rollers, as herein fully set forth and described.”

27. For a *Pump Gauge*, for ascertaining the depth of the water in the hold of a vessel; James D. Woodside, city of Washington, District of Columbia, July 14.

An opening is to be made in the side of a ship's pump, just below the upper band, to receive a small brass box, which may be two inches high, and one and a half wide, and which is to be furnished with a door, to close the opening when the gauge is not in use. A small roller crosses the upper end of the box, and over this passes a tape, graduated into inches and half inches. One end of this tape descends through a casing, nearly to the bottom of the hold, and has a float suspended to it, which will be buoyed up by the water. To the other end of this tape, a counter weight is attached, to take up the slack, by drawing the tape over the roller as the float rises in the water. The patentee says, “What I claim as my improvement, is the vast difference between ascertaining the depth of water in the hold of a

vessel by the ordinary sounding rod, and this instrument;—that the depth is more accurately ascertained, as the vibration occasioned by the rise and fall of the water, owing to the motion of the vessel, is at all times perceptible by the graduated tape; therefore the mean is the correct depth of water in the vessel.”

This claim is very awkwardly expressed, as it is not made for the improved instrument as described, but for the vast difference between the result obtained by it, and by the ordinary means used for the same purpose; and this is claiming the effect of a machine, instead of the machine itself.

28. For a *Washing Machine*; Jesse Gilman, Waterboro', York county, Maine, July 14.

Upon looking at the drawing of this instrument, we supposed that it was intended for grinding, as it is very much in the form of certain mills. It consists of a conical tub, two feet high, and two feet in diameter at the top, within which are to be placed rollers reaching from top to bottom, and turning upon pins in their centres; these rollers are to be two inches in diameter at their upper, and one at their lower, end, and to be nearly in contact with each other. A nut, nine inches in diameter at top, and six at bottom, and having twelve grooves around it, extending from top to bottom, is to be turned by a handle fixed to the shaft, above the nut. “Which machine is of wood, except the pivots, which are of iron.”

The suds and clothes are, of course, to occupy the space between the nut and the circle of rollers, and we are not quite sure that a straggling tape, or some unlucky frill, or furbelow, may not become lapped round the rollers, and make unwelcome work for the seamstress; at all events, we have heard such a complaint made against machines furnished with similar rollers. We might urge other objections, but leave them to be discovered by the washerwomen, should the machine ever find its way into their hands.

29. For an improvement in *Rail-road Cars*; Joseph S. Kite, city of Philadelphia, July 14.

(See report, vol. xiv., p. 385.)

30. For a *Platform Balance* for weighing; Samuel L. Hay, city of Boston, Massachusetts, July 14.

The platform balance which is the subject of this patent, is suspended, so far as we know, in a manner different from all those which have preceded it. In this machine there are four levers, which are constructed, and operate, like steelyards, two on each side of the platform, attached to it, and to the frame within which it stands. The fulcrum of each lever is fastened to the frame, one end thereof to the platform, and the other to the transfer rod, by which the motion is to be communicated to the graduated steelyard. The four levers which are attached to the platform, have their fulcra at different distances from their ends; the two on one side differing from the two on

the other. In the drawing, the distances, or lengths of the arms in one pair, are as 1 to 10, whilst in the other they are equal, like a scale beam. This is to cause the platform to descend horizontally, whilst these levers operate upon the transfer beam. The claim is to "Suspending a scale, or platform, by four levers, to a transfer beam, in the manner described, for the purpose of weighing."

31. For a *Bedstead for Invalids*; William Leo Wolf, city of New York, July 15.

This bedstead differs, materially, in its construction, from those ordinarily made for invalids, of which several are patented, and many others described in medical books, most of them bearing a strong resemblance to each other. That before us is intended to be inclined in any direction that may be required; for which purpose, the sack-ing, or girths, upon which the mattress rests, is attached to a frame placed within the ordinary rails of the bedstead, and is so made that it can be detached from this frame at pleasure. The secondary frame is made to swing on centre pins, passing through the head and foot rails, and on similar ones passing through the side rails, there being other pins to detain it in a horizontal position, or any other in which it may be placed.

By swivelling on the head and foot pins, the patient may have his bed inclined in either direction, provision being made for placing a side board, duly lined and wadded, to support him as the apparatus is turned round. If necessary, the frame upon which he rests can be inverted. When this is to be done, a mattress is placed upon him, over which girths are passed by means of fixtures for that purpose, and a support is provided for his head. When inverted, the original bottom and mattress may be removed, and that and the clothes renewed.

There is no claim made, but the apparatus is, we think, sufficiently characteristic and novel, in its general construction, to be distinguished from all others.

32. For a *Cooking Stove*; Samuel W. Phelps, Cincinnati, Hamilton county, Ohio, July 16.

The claims made by the patentee are the following :

"1st. The reflecting oven being attached to the stove, and its sides being composed of movable doors, which can be managed to open or shut, to regulate the heat in the oven.

"2d. The small flue from said oven into the smoke flue, which carries off the effluvia of the meats, and prevents their amalgamating flavours.

"3d. The position, plan, and construction, of the furnace and smoke flue, being such as to burn either wood or coal, and the manner in which the front grate may be slid up or down.

"4th. The convenient manner in which all these advantages are combined within a small space, on a simple plan, for the use of families."

33. For a *Rarefying Oven Cook Stove*; Samuel W. Phelps, Cincinnati, Hamilton county, Ohio, July 16.

The following improvements in this stove are claimed as new and useful:

"1st. The flue passing as it does out of the back of the oven, whereby the back of the oven is heated, and room is left at the side and end of the furnace for reflectors.

"2d. The bottom and back plates of the oven are made thinner than the other sides thereof, in proportion to their distance from the source of heat, and thus each side of the oven becomes equally heated at nearly the same time.

"3d. The air chamber interposed between the furnace and the oven.

"4th. The convenient combination of these advantages in the most condensed and suitable form for the use of steamboats and hotels, &c."

There is, in general, so little of new invention manifested in cooking, or other, stoves, and their number is so great, that we rarely think it necessary to give the particulars of their construction, as this, in general, is a mere matter of arrangement. When there is any thing which appears to be really new, we endeavour to make it known, and more than this but few of our readers would desire. We have passed over the two stoves, just noticed, by merely abstracting the claims, some of which most certainly could not be sustained, in their individual characters; but we have thought proper to leave them without animadversion.

34. For a machine for *Cutting Laths*; Dana Hubbard, Wheeling, Ohio county, Virginia, July 18.

A plank, of about eight feet in length, is to be fixed so as to slide backward and forward, horizontally, in grooves made for that purpose, in a strong bench or frame. The plank is to receive its traversing motion of about eight inches, from a pitman, or shackle bar, attached to one end of it, which is acted upon by a crank on a fly wheel shaft. A knife, the full length of a lath, and from four to six inches wide, is to be fixed upon the sliding plank obliquely, making an angle of about twenty degrees with the edge thereof. The stuff to be cut is first sawed into boards, and then cross-cut to the length of a lath; these boards are dropped edgewise into a groove, falling so as to be cut by the knife, the board bearing against a cutting block, faced with steel on its under side. The laths pass, as they are cut, through an opening made in the plank for that purpose.

The claim is to "the oblique position of the knife, which, together with the sliding of the plank to which it is attached, and the stationary cutting block, produces the compound motion that partly cuts, and partly rives, the lath from the prepared material, with little expense of power."

An oblique position has been repeatedly given to knives for cutting laths, and this, therefore, standing alone, is not the proper subject of

a claim; we think, therefore, that this part might have been advantageously altered; the general construction and arrangement of the machine are, probably, sufficiently novel to justify a patent, although none of its individual parts are new.

35. For a *Cheese Press*; Sylvester Kibbe, Schoharie, Schoharie county, New York, July 18.

A train of wheels is made to act upon a vertical shaft, which has teeth upon one of its sides, forming it into a rack; upon the bottom of this shaft there is a follower, which is to press upon the cheese. The train consists of three pinions, and two wheels, there being one pinion on the shaft of the crank which is to be turned by hand, and another taking into the rack on the shaft of the second wheel. A weight may be hung upon a lever extending out from the crank shaft, to make continual pressure. The claim is to "the arrangement and combination of machinery, as described, by which the desired effect is produced with the greatest possible ease and expedition."

Those acquainted with machinery will perceive that this is nothing more than the common rack and pinion press; and that, although it is said to act with the *greatest possible* ease and expedition, yet, by the employment of one wheel and two pinions, duly proportioned, the ease and expedition would be still *greater*, as there would be less friction.

36. For a *Steam Fireplace*; John W. Cochran, Lowell, Middlesex county, Massachusetts, July 18.

The apparatus here patented is intended to heat dwelling houses, ships, and other places, by means of steam generated by a fire in a common open fireplace, or caboose, without interfering with the use of the fire for culinary, or other, purposes.

A boiler of metal is to be made in the form of the back and jambs of an ordinary fireplace. The back part of this boiler is to fit against the back of the fireplace, and its ends against the jambs; it is not, however, we apprehend, to be in contact with them, but at a sufficient distance to allow heated air and flame to pass between them. The height of this boiler, judging from the drawing, will be about equal to that of the breast of the fireplace, and its depth at bottom about a foot, whence it is to slope back as it ascends; it is to have feet at the bottom, to raise it from the hearth. There are to be two long, rectangular cavities in the front, something like ovens, into which the flame is designed to enter, to increase the heating effect, the double plates surrounding these cavities. Water is to be admitted through a pipe at top, and steam is to escape through another pipe, and to be thence conducted around a room, or wherever it may be wanted.

"The said John W. Cochran claims as his own invention, in the above mentioned machine, the application of steam to the heating of dwelling houses, ships, and other places requiring an increased temperature of the atmosphere, by means of a metallic steamer, or

boiler, placed in a common fireplace, stove, or caboose, in such a manner as not to impede the use of the same for all ordinary purposes."

We are very apprehensive that not more than one of these boilers will ever be constructed, and that this one, after having been a source of considerable expense, and more vexation, will be laid by until a more convenient season, which will never arrive. The warming by steam is not quite so simple and easy as was at one time supposed; and had the present inventor made himself acquainted with the history of what has been done and attempted in this way—and had he, moreover, acquired an intimate knowledge of the relationship between steam and heat, we are very sure that he never would have taken his present patent. We cannot here discuss those general principles which belong to this subject, nor indeed can we urge the numerous objections to the plan before us which present themselves; we will observe, however, that the flame of the fire will never find its way into the rectangular cavities, as there is no draft through them, and that, among many other things, we ought to have been informed by the patentee in what manner the boiler is to receive its regular supply of water, what is said upon this point being altogether insufficient.

37. For a *Bush for Mill Spindles*; Samuel Merchant, Ohio county, Virginia, July 22.

Metallic wedges are to be so placed in the common wood bush as to form a collar around the neck of the spindle, with a piece of gum elastic, or some similar material, between the wood and the metallic wedge, so as to give elasticity thereto, and thus to relieve it, in some degree, from dead friction.

"The improvement which I claim is the simple manner or application of block tin, or metallic wedges, to keep in the wood of the mill bush; and the application of the same, or with the addition of a screw and nut, to other machinery.

"The application of gum elastic, or of some other elastic substance, between the metal and the wood, by which the disadvantages occasioned by dead pressure are prevented.

"The application of the metallic substance for the purpose of relieving from the heat occasioned by the friction of the spindle on the common wood or rope bush, by which means the danger of a mill taking fire by friction is entirely prevented.

"The application of weight, lever, or otherwise, by which the wedge is kept constantly confined at any desired pressure, to the spindle, or gudgeon."

38. For an *Improvement in Wagons, or other Wheeled Carriages*; Reuben Rich, Albion, Oswego county, New York, July 22.

The specification of this improvement is somewhat laconic, yet the writer terminates his description as though the few remarks made had been productive of some fatigue. The whole which can be called

descriptive, is in the following words: "The wheels are the same as common carriages, except the hubs, and the axles in the hubs. The axle in the hubs is a bar of iron through the hub, with the ends made round, sticking out of the hubs about two or three inches, as the case may be. These axles are made permanent in the hubs, and revolve round with the wheels, and the frame is explained in the drawing; so it needs no further explanation about it."

The said drawings show the wheels, with short axles through them, running in boxes fixed in timbers on each side of them. We have heretofore had occasion to notice such a mode of fixing wheels, and as they were not then new, we apprehend that they must still remain in the same predicament.

39. For a *Retaining Box for Oil in Upright Journals*; Henry Barton, Rochester, Munro county, New York, July 22.

Below the box in which the upper gudgeon of a vertical shaft revolves, there is to be a cup for containing oil. The box is secured to the frame work by a flanch on its upper side, and descends upon the gudgeon so that a cap fastened upon the shaft, just below the box, may have its sides rise so as to surround the said box, without touching it. The cup may then be nearly filled with oil, which, from the height of the rim of the cup, will necessarily flow in between the gudgeon and the box. When the shaft is to have a rapid motion, this, as the cup revolves with it, would tend, by centrifugal force, to throw the oil out of the cup; a recess, or groove, is, therefore, formed round the lower part of the cup, to retain the larger portion of the oil, and thus to counteract its tendency to overflow.

The advantages derived from the application of the retaining box are stated to be, "first, the effectual preservation of all such bearings from becoming dry, heating, and wearing, and deranging their relative positions, prevent fire from friction, which has not unfrequently been the result of rapid motion. Secondly, a great saving of oil, as the cup saves all that is applied. Thirdly, a saving of time, for, with the addition of the retaining cup, once a week will be often enough to apply oil, when, without it, from once to four times a day is required, in most cases. Fourthly, cleanliness in all fine machinery, as nothing can flow down the shaft, or spindle, to foul or otherwise disfigure or injure below."

40. For a machine for *Blocking Horse Collars*; Nathan Post, Norfolk, St. Lawrence county, New York, July 24.

Who is the true and original inventor of the mode of blocking collars which is the subject of this patent, it is not for us to say, as we are not furnished with the necessary evidence. The claim made in the present patent, however, is to an apparatus perfectly similar to that described at p. 28 of our last number, and patented by Ebenezer Whitney, of Chenango, Broome county, New York. The only thing claimed in the patent before us, is the drawing of the rope round the collar, when upon the mould, by means of a screw, operating

precisely in the same way with that last mentioned. The block, in the first patent, was to be made of cast iron; but this has nothing to do with the principle of the thing, as this part of the apparatus is in common use.

41. For a *Regulated Pressure Engine*; Daniel Livermore, Civil Engineer, Blairsville, Indiana county, Pennsylvania, July 24.

This is a very ingeniously contrived hydraulic engine, for applying the power of water to drive machinery, by a regulated pressure. The description of it is of great length, and it was our design to have epitomized it, accompanying our account with the necessary cuts. The article is not, however, yet prepared, and as we anticipate the reception of an account of its actual operation from the inventor, who is engaged in carrying it into practical operation, we shall, for a time, postpone the intended publication.

42. For a *Plough*; Henry Peachey, city of Philadelphia, July 25.

This patent is taken for an improvement in the mould board, which is not very clearly described. Its difference from other mould boards is said to consist in its "being divided into ribs, or separate portions, each rib being placed beyond the others, rising in a gradual curve;" "the number of ribs may vary according to the size of the plough;" "the principle of the mould board receding to raise portions of mould in succession, is the invention and discovery claimed."

43. For a *Thrashing Machine*; Gideon Hotchkins, Windsor, Broome county, New York, July 25.

Although a very laboured description is given of this thrashing machine, and certain distinct claims are made, there still is not, in our apprehension, any thing presented which is new. The machine is of the cylinder and concave kind, with beaters which swing upon bolts passing through circular heads, in a way that is well known. Among other things claimed, is the frame, which, we are informed, may be of cast iron, or partly of iron, and partly of wood: and we are told of many other variations that may be made in other parts, of which there can be but little doubt, as we believe they have all been actually made, and that more than once.

44. For improvements in the *Process of Tanning*; Edward S. and Daniel Bell, Smithfield, Jefferson county, Virginia, July 28.

(See specifications.)

45. For a *Female Auger for cutting Wagon Spoke Tenons*; John Lenher, Cocalico township, Lancaster county, Pennsylvania, July 28.

Bits for cutting round tenons, or pins, have been long, and well,

known, and have also been used for tenoning spokes for wheels. So far as we can judge from a very imperfect description, there is nothing new in the one which is the subject of this patent; if there is, it consists merely in a change of shape, without the production of any new effect, or the employment of any improved means.

A patent was obtained for an improvement in augers, or bits, of this kind, by Mr. Abel Conant, in June, 1829, as may be seen by turning to p. 176, vol. iv.; at which time it was not pretended that there was any thing new in the thing itself. The plan, as there proposed, we think decidedly superior to that now offered.

46. For a *Saw Knife*; Lorenzo Graham, Paris, Oneida county, New York, July 29.

Take a common knife, and cut teeth in the back of it, and you have the patent *saw knife*, which, we are told, may be used for culinary purposes, for pruning, or for any thing else which may be found suitable.

47. For an improvement in the mode of *Chilling Cast Iron Wheels for Rail-road Cars*; Phineas Davis, Civil Engineer, city of Baltimore, July 29.

(See specification.)

48. For promoting the *Combustion of Anthracite, in Locomotive, and other Steam Engines*; Phineas Davis, Civil Engineer, city of Baltimore, July 29.

(See specification.)

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a Patent for a Machine for picking Curled Hair. Granted to JOHN THOMPSON, 3d, of Marblehead, in the county of Essex, and State of Massachusetts, July 8th, 1834.

This may certify, that I, John Thompson, 3d, of Marblehead, in the county of Essex, and State of Massachusetts, have invented a new and useful machine for picking curled hair, for stuffing mattresses, chairs, &c., and that the following is a full and exact description of the construction thereof, and the manner of using it.

I construct a suitable frame, in form much like those in general use for cylinder thrashing machines, as the picking is effected between a cylinder and concave, operated upon in a manner bearing some resemblance to those machines. I place an endless feeding apron, horizontally, upon which the hair, curled into ropes in the usual way, is to be placed, and from which it passes between two feeding rollers, the lower one of which carries the feeding apron, and the upper one is borne down by means of weighted levers, or otherwise, so as to

hold the hair rope sufficiently firm to resist the action of the points upon the revolving cylinder and the concave.

The cylinder which I have made, and which answers well, is of wood, two feet two inches in diameter, and about eighteen inches long. It is driven by means of a cog wheel, taking into a pinion on one of its axes, the wheel and pinion being to each other as 7 to 1. Upon the opposite axis there is a whirl, a band from which passes round a band wheel on the axis of the lower feeding roller, which it drives, with a slow motion, the wheel being twenty times the size of the whirl. The cog wheel I turn by means of a crank handle, causing the cylinder to carry the hair upwards, between itself and the concave. This latter is a quadrant of a circle, extending from the feeding apron to the apex of the cylinder; the space between the two being about one and a half inch.

In the cylinder I set rows of pins, made of round wire, and pointed; these project out about an inch, and they are about the same distance asunder; these I place in a line across the cylinder. There may be sixteen such rows, placed in pairs, about three inches apart, so as to make eight double rows. At each edge of the concave, I place similar double rows of pins, leaving the remaining space blank, to admit of the proper stretching of the hair. The pins are so placed, that those on the cylinder pass between those on the concave without touching.

Although I have designated the dimensions of certain parts of this apparatus, I do not intend thereby to limit myself in this particular, as these admeasurements may be departed from, and the particular arrangement varied, whilst the principle of action will remain the same; as, for example, the concave may be placed below the cylinder, and the hair carried downwards; the mode of gearing, also, and the number of rows of pins, &c., may be changed. I do not, therefore, claim the separate parts herein described; but what I do claim as my invention, is the employment of a cylinder and concave, furnished with points, and operating in the manner set forth, by which it is adapted to the picking of curled hair, instead of picking the same by hand, as has heretofore been practised.

JOHN THOMPSON.

Description of certain improvements in the Process of Tanning. Patented by EDWARD S. and DANIEL BELL, Smithfield, Jefferson county, Virginia, July 28th, 1834.

The objects of the improved modes of procedure for which this patent is obtained, are, *First.* The softening the hides, or skins, and the freeing them from grease. *Secondly.* Expanding the hides preparatory to their receiving the tan. *Thirdly.* The procuring the *tannin*, or tanning principle, from the ooze, pure, by filtering. *Fourthly.* Causing the tanning lixivium more readily to enter the hides, by the use of mechanical compression made upon them, under the surface of the ooze, and thereby shortening the operation.

The claims made are to the modes, and apparatus, adopted for the attainment of these ends. For softening the hides, twenty-one and a half pounds of caustic lime, unslaked, and levigated, and sixteen pounds of carbonate of potash, and one pound of carbonate of soda, are to be added to every two hundred cubic feet of water. In the alkaline liquor thus formed, the hides are to be suspended in the usual way, by which means they will be completely softened, and have their grease neutralized, in from twenty-four to thirty-six hours.

The expanding or raising, of the hides is to be effected by adding to every hundred feet of pure gallic lixivium, one pound of tartaric, and one pound of sulphuric, acids; by suspending the hides in this solution, a complete expansion, it is said, will take place in six or eight hours.

To procure the tanning liquid pure, the ooze, after having been obtained from the bark, is to be filtered by putting it into a vessel of the nature of the common hopper for obtaining ley, the bottom and sides of which are to be covered with about eight inches of raw cotton, and filled in with fine refuse tan, or exhausted bark. Through this the pure tanning liquor is to be passed, and collected in a proper receptacle.

The most important part of the process, however, appears to be the following, namely, the subjecting the hides or skins to mechanical pressure under the surface of the ooze, or tanning liquor. The apparatus employed for this purpose is fully described, and well represented in the drawing. A platform is to be made, and placed upon firm supports, which platform may be situated between two vats containing ooze, and in which the hides are suspended. The platform stands a few inches below the level of the ooze in the vats, which is admitted to flow over it, there being ledges which serve to retain it upon the platform. Upon this platform, the hides are to be submitted to the requisite degree of pressure. The tanning liquid is to be kept, by means of heaters, at a temperature of 98° Fahrenheit. The hides are to be taken from the vats, and spread smoothly upon the platform, and then a kind of carriage, sustained upon two long rollers of wood, or brass, is made to pass over them, the carriage being loaded with such a weight as may be necessary for the skins to be operated upon. The guides, ways, friction rollers, pulleys, &c., which are employed in the moving of this carriage back and forth, we need not describe. The object of this pressure is to remove the watery particles from the pores, which are left there after the ooze has become exhausted by the combination of its tannin with the skin; the pores are thus closed, and the skin condensed, and in that state it is to be slipped again into the vat, without exposing it to the air, where, in the course of six or eight hours, it will again be expanded by the refilling of the pores with fresh ooze. This operation is to be repeated, employing a stronger tanning liquid after the first has produced all the effect expected from it; and thus, in succession, a stronger and stronger, until the process is completed, "which, for heavy leather, takes place in six or eight weeks, and for light skins, in from six to twelve days.

To economize time and labour, there must be a series of such vats and platforms as have been described, thus enabling the workman to proceed readily from a weaker to a stronger solution, these varying according to the nature of the skins; and requiring to be regulated by the judgment of the workman.

Specification of a Patent for an improvement in the mode of Chilling Cast Iron Wheels for Rail-road Cars. Granted to PHINEAS DAVIS, Civil Engineer, city of Baltimore, July 29th, 1834.

Whereas, it has been found that, in the casting of what are called chilled wheels, for rail-road cars, that the part of the wheel which is most liable to wear, namely, the rise, cone, or curve, between the tread of the wheel and the flanch, is usually less hard than the other parts, for the obvious reason that the metal is there less rapidly cooled by the chill:

Now, be it known, that I, Phineas Davis, of the city of Baltimore, in the state of Maryland, have invented a new and improved mode of chilling such wheels, in which, by the cooling influence of a hoop, or ring, of wrought iron, made and placed in the flask, or mould, at the time of casting, in a way to be presently set forth, I have succeeded in removing this difficulty; and I do hereby declare that the following is a full and exact description thereof.

Those acquainted with the business of casting iron, are aware that the operation of chilling consists in placing within the mould, so as to make a part thereof, a piece, or pieces, of iron, which, when the metal is poured in, rapidly cools that portion with which it is in contact, and renders it hard. In the casting of wheels for rail-road cars, the chill consists of an iron hoop, of considerable thickness, and with which the whole face of the wheel, including its flanch and tread, is in contact; but from its form, as I have already indicated, there is one part of it, uniting the tread with the flanch, which is less rapidly cooled than the others. To remove this difficulty, I employ what may be denominated an internal chill; this consists of an iron hoop, or ring, which I usually form of round rods, half an inch in diameter, giving to the hoop, or ring, such a diameter as shall cause it, when laid in the flask, and the casting made, to be surrounded by, and completely imbedded within, the cast metal, and to stand about half an inch within the body of that part of the wheel which forms the curve, or cone, before spoken of, and opposite the centre thereof. But as, in the usual thickness of the rims of such wheels, the said ring would be covered on the inside by only a thin shell of metal, I form such a bead, projection, or thickening, opposite thereto, on the inside of the pattern of the wheel, as will cause the metal to cover it, about three-eighths of an inch.

Iron founders are well acquainted with the means of supporting such articles as the before described ring, within the flask, so that they may be embraced within the cast metal. The method which I have adopted of effecting this in my wheels, is the following. I take

four strips of iron, which may be one-tenth of an inch thick, one-fourth of an inch broad, and four or five inches long, and one end of each of these I bend round the ring, so as to clasp it tightly, the remainder of the strap forming a shank, or bearing, which rests upon the sand in the lower flask. These clasps stand at equal distances apart, and, when in the mould, point towards the centre of the wheel. The pattern must be so made, that the parting of the sand in the flask will be opposite to the centre of the ring. Facing sand, of the usual description, should be used in making the mould. The ring, before being placed in the mould, should have its surface made bright, by filing, or otherwise. It must also be heated, say to the temperature of boiling water, to dissipate any moisture, or other evaporable matter, which might otherwise cause it to blow. The casting should be performed immediately after placing the ring in the flask.

Although I have described the mode of procedure in casting, and in other parts of the process for forming wheels within which are imbedded a ring of wrought iron, I do not claim these as making any part of my invention; but I do claim the using of a hoop, or ring, of wrought iron, to be laid, and cast, within the body of a rail-road wheel, in such manner as to operate as an internal chill, to cool more rapidly, and consequently to harden, the part which I have described under the name of the curve, or cone thereof; I claim no more.

PHINEAS DAVIS.

Specification of a Patent for Promoting the Combustion of Anthracite in Locomotive, and other Steam Engines. Granted to PHINEAS DAVIS, Civil Engineer, city of Baltimore, July 29th, 1834.

Be it known to whomsoever it may concern, that I, Phineas Davis, of Baltimore, in the state of Maryland, have invented a new mode of promoting the combustion of anthracite, and other fuel, in the furnaces, and fireplaces, of locomotive, and other steam engines, and that the following is a full and exact description of my said invention.

The means by which I promote the combustion of anthracite, or other fuel, is by the employment of fan wheels, or vanes, revolving within drums, in a manner well known to machinists; and my improvement consists in the arrangement of the apparatus by which I employ the waste, or escape steam, to give motion to such fans, or vanes. For a locomotive engine, I usually employ two fan wheels, and I have found them, and their appendages, to answer well in practice, when made of the dimensions which I am about to indicate, although, in this particular, there may be considerable variation, without injury to the effect. The wheels may be from eighteen to twenty inches in diameter, and from ten to twelve inches wide; they may be placed upon the same axis, and at the distance of about eighteen inches from each other in the clear; in many instances, two vanes to each wheel will be sufficient, but a greater number may be used; the drums within which the wheels revolve, do not differ from those or-

dinarily employed in similar blowing machines. The wind is conducted from these drums through tubes seven or eight inches square, which lead from them in the direction of a tangent to the circle described by the wheels, into a tight ash pit under the grate of the furnace; and the air is thereby forced through the fuel with such velocity, as to cause the fire to burn with great energy, so as to produce an abundant supply of steam from anthracite, notwithstanding the tendency of that fuel to pack, and thereby to impede the ordinary draft, when employed for locomotive engines.

In order to give motion to the fan wheels, I place a steam wheel upon the same shaft with them, generally at the centre thereof, so as to be equidistant from them. This steam wheel is constructed in the same manner, nearly, as the wind wheels, differing from them principally in its dimensions, and its being acted upon and impelled by an elastic fluid, (steam,) whilst they act upon and impel an elastic fluid, (air.) The steam wheel has usually four wings, or vanes, from three to five inches in width; and it may be from twenty to twenty-four inches in diameter. This wheel is enclosed within a drum, of such dimensions as just to allow the vanes to revolve freely within it. A tube connected with the exhaust pipe, from each end of the cylinder, enters the drums tangentially, and the waste steam is thus injected forcibly against the extreme ends of the vanes, impelling them, and consequently the wind wheels, with great velocity. The steam which thus enters escapes at an opening, or openings, in the centre of the drum, made similar to those at which the air enters from the action of, and to supply the, fan wheels.

As it is necessary to command the blast, so as to regulate the intensity of the fire, which would often be too great were the whole of the waste steam discharged upon the steam wheel, I attach a branch pipe to that which conducts the steam from the cylinder, or cylinders, to the steam wheel, and employ a valve, or valves, so arranged as to enable me to direct the whole, or any desired portion, of the steam, through such branch pipe, and thus attain the desired object in the most perfect manner.

The continued fresh supply of steam, and the diminished centrifugal force of that which has acted upon the vanes, continues, however, to operate until the moment of its escape at the opening surrounding the centre, provided the parts are properly proportioned to each other, for although its energy is diminished, so also is the actual velocity of the vane, as the centre is approached.

The opening in the steam wheel, for the escape of steam, I usually make on one side only, and cover this with a cap, or drum, and from this cap, or drum, a tube extends upwards to carry off the steam in such a way that no inconvenience may be experienced by its discharge.

Although I intend always to use the waste steam from the cylinder, or cylinders, it is manifest that steam may be supplied from the boiler, to act upon the steam wheel; but this procedure would not be economical, and would yet be a manifest invasion of my rights.

I am aware that wind wheels, such as I have described, have been

used to supply a blast to the furnaces of locomotive engines; I am also aware that wheels have been propelled by the action of steam upon wings, or vanes, surrounding them; I do not, therefore, claim either of these, singly and separately, as my invention; but what I do claim is the combination and arrangement of the parts such as I have described, by which the waste, or escape steam, is made to act upon vanes revolving within a drum, for the purpose of giving motion to wind wheels, to feed the furnaces of steam engines.

And I do hereby declare, that I have herein explained and set forth what I believe to be the best method of applying the waste steam to accomplish the proposed object, but that I do not intend thereby to confine myself to this precise mode of construction and arrangement, but to vary the same as I may find convenient, whilst I operate upon the same principle, and attain a like end by analogous means.

PHINEAS DAVIS.

ENGLISH PATENTS.

Specification of a Patent granted to HENRY CRANE, Merchant, and JOHN YOUNG, Patent Lock Manufacturer, for their invention of certain improvements in the making, manufacturing, or forming, of Iron Hoops for Casks, and other purposes. Sealed 20th March, 1834.

These improvements in making, manufacturing, or forming, of iron for hoops for casks, and other purposes, consist in giving to the narrow strips of hoop iron a curved figure; that is, bending the strips of iron from the usual straight form in which they are delivered by the ordinary operation of rolling, into such a curve suited to the diameter of the barrel round which the hoops are intended to bind, as will enable them, when formed, to lay close to the conical or elliptical surface of the barrel. This is effected by a peculiar method of acting upon the strips of iron by means of rollers, in order that such required lengths of iron, when cut off and bent round into the circular hoop shape, may be formed slightly tapering, or as the frustrums of cones.

The method by which this is effected, is by drawing out the bar or rod of iron by rolling, in the first instance, in a heated state, in the usual way, until it has been reduced to nearly the required thickness; we then set the rollers, so that their axles incline at a slight angle from the true parallelism, by which means the peripheries of the rollers will be nearer together at one end than at the other, and the strips of iron being then passed between these inclined rollers, will be necessarily compressed, or formed on one edge thicker than at the other edge—that is, of a wedge shape, if cut in a transverse section. This may be done by relieving the screws which confine the axle at one end, and tightening them at the other end; or the same might be effected by making the grooves and ribs of the two rollers inclined to each other, instead of parallel.

When the strip of iron has assumed this wedge shape, in its transverse sectional figures, we then pass it, in its heated state, between a pair of parallel rollers, which, by pressing principally the thicker part of the substance of the strip of iron, causes that thick part to expand and elongate more than the thinner part of the strip, and, consequently, to extend or elongate the strip more on one edge than on the other.

This mode of operation will cause the strip of iron, as it is discharged from the parallel rollers in the last instance, to assume the form of a regular curve, and which curve may be varied to suit any required diameter and inclination of the surface of the cask, or barrel, by varying the inclination of the rollers, or the bevel of the groove, by which the strips are compressed into the wedge shape, that is, thicker on one edge than on the other; and in order to prevent the strip of iron from bending into irregular curves, as it passes in its heated state from the rollers, we have found it useful to place a curved guide, or conductor, near the rollers, which will enable the workman, as he draws out the strip of iron from the rollers, to preserve its desired figure with great accuracy.

Lastly, we wish it to be observed, that as the rolling of iron for the purpose of bringing it into thin and narrow strips for the manufacture of hoops, is not new, of course that process is not to be considered as claimed by us; but the taking of strips of iron, previously made thicker on one edge than on the other, and passing them between parallel rollers, for the purpose of expanding the metal on one side of the strip more than on the other side, and thereby giving to the strip a curved figure as it is discharged from the rollers, being, to the best of our knowledge and belief, new, and never before employed by any other person, or persons, in the manufacturing of hoops, we claim that mode of operation as our invention, and forming the essential feature of our present patent right.

[*Lond. Journ.*

Specification of a Patent granted to FREDERICK STEINER, Manufacturing Chemist and Turkey Red Dyer, in consequence of a communication from a foreigner residing abroad, for an invention of a certain process, or processes, by which spent madder, or madders, that have been previously used, can be made to yield a great quantity of colouring matter; and for dying with the same, in various colours, all descriptions of cotton, linen, wool, silk, or any mixture of them; and also for improving for dying, madders that have not been previously used. Sealed 2d June, 1832.

The object of the patentee is to partially restore the property of madder, that is, madder which has been used for dying the colour called Turkey red. When the colouring matter has been extracted from the madder by the ordinary process employed for that purpose,

and it is in a state called spent, the spent madder is then to be mixed with a solution of weak sulphuric acid, that is diluted by water; which acid, by acting upon the vegetable fibre, will revive its red colouring properties.

Other acids may be employed for this purpose, or salts having an acid base; and when the acid has acted sufficiently upon the madder, a quantity of pure water is to be poured upon it, for the purpose of taking up the acid. This water is to be drawn off from the surface, and fresh water introduced several times, until the acidity is completely removed.

The colouring property of the restored madder will be about one-third of that which it originally gave out by the ordinary process of extracting, and it may be either dried, or used in its wet state; the latter of which is preferred, as causing less trouble.

The colour extracted from the restored madder will be fugitive in all articles but cotton; for other goods, it may be rendered permanent by the addition of nutgalls, or other astringent and tanning matter.

Observing these provisions, goods of every kind may be dyed by the restored madder, using about three times the quantity which would be required if the madder was fresh; the same means being resorted to in preparing the goods, which are commonly adopted in dyeing such articles; and the colouring property of madder in its fresh and unused state may be greatly improved by treating it with acid in the same way as spent madder. [*Ibid.*]

Specification of a Patent granted to JOHN PAUL NEUMANN, Merchant, for certain improvements in making or producing leather from hides, and other skins, being a communication from a foreigner residing abroad. Sealed December 31st, 1833.

The novelty of this invention consists in employing the hop plant, whether root, stalks, or leaves, or any part thereof, to be used by itself for the purpose of tanning, or in conjunction with any vegetable substance or material containing tanning matter. The patentee states that the mode which he chiefly prefers using this plant for the purpose of tanning, is to grind or reduce it to as fine a powder as practicable; and when so prepared, it may be employed for every mode of tanning, in the same manner as bark, or any other vegetable tanning material, according to circumstances, to suit different hides or skins. This tanning matter may be applied either warm or cold, whether in extract, or mixed with other matter; the practical tanner will soon perceive the mode which is most applicable for the different hides, or skins, which he means to subject to the process of tanning, for different hides and skins require different modes of treatment. With some, it is necessary to use heat, or warmth, and others should be tanned cold; but he prefers having the hides, or skins, prepared in the usual mode hitherto followed by practical tanners.

The principal novelty in this invention consists, as before stated, in using the hop plant for tanning, which has never before been em-

ployed for that purpose, and, by means of this process, it will be rendered more extensively useful and valuable. [*Ibid.*]

¶ TRANSLATIONS FROM FOREIGN JOURNALS.

*Extract of a Report upon the employment of Hot Air in smelting Iron with Charcoal. By M. E. GUEYMARD, Engineer in Chief of Mines.**

A successful experiment in the smelting of iron by the aid of the hot air blast, has been made at the furnace of Rioupéroux, (Department of Isere.) In this furnace, the distance from the blowing machine to the tuyere was insufficient for the erection of the apparatus for heating the air which the machine furnishes; they were obliged, therefore, to make the conduit pipe semicircular.

Six kilns, or ovens, were made with one chimney, 54 $\frac{1}{2}$ feet (French) high, placed against the stack of the furnace. The fuel used in them was anthracite, which was applied to heat a pipe eight inches in diameter, and ten feet long; the part of the tube which traverses the fire was protected by a coating of fire clay, one inch thick, covered by a shield of cast iron, which received the direct action of the fire.

Five months' work have proved the efficacy of this arrangement; the expense of the construction of the apparatus for heating, including a tube for water, amounted to the sum of 5,009 francs, (1,001 dollars.)

Upon the blast pipe, and close to the tuyere of the furnace, is placed an air gauge, and a thermometer. The consumption of fuel by the air oven has been fixed at 150 kilog. (300 lbs.) of anthracite in twenty-four hours.

The experiments were commenced on the 3d of April; the fires were lighted in succession, and, on the 15th of May, five of them being lighted, the temperature of the air was raised to 125° R., (313° Fah.) and even as high as 130° R., (324° Fah.)

Before the introduction of hot air, the furnace was charged each time with 65 kilog. (130 lbs.) of soft charcoal, and with 77 litres (2 $\frac{3}{4}$ cubic feet) of ore.

Gradually the hot air was introduced, the temperature being raised more and more. They have been able to use with the same load of charcoal, quantities of ore increasing as 82, 87, 92, 102, and up to 105, litres; a quantity which has not been exceeded. It was observed that, at this maximum charge, the scoria, or slag, was more liquid, and the metal of a better quality, and finer than before.

The consumption of the five fires was 750 kilog. (1500 lb.) of anthracite in twenty-four hours.

When they worked with cold air, the mouth of the tuyere was eighteen lines (1 $\frac{1}{2}$ inches) in diameter, and the pressure of the air equalled twenty-four inches of water. Upon the introduction of the hot air, the diameter of the mouth was increased to twenty lines, (1 $\frac{2}{3}$

* Translated by request of the Committee on Publications.

inches, and the pressure decreased to twenty inches. The number of charges were forty in twenty-four hours, in the first case; but in the second, they could not exceed thirty-four, or thirty-five. Afterwards, having restored the pressure to twenty-four inches, they were enabled to increase the number of charges to forty.

The economy of fuel by the use of hot air, at the furnace of Riou-pérourx, may be estimated by the results of the castings made during the month of June, being about the average of three months' experiments, and about the same with those of the months of July and August.

During the month of June, 57,989 kil. of pig iron were made by the consumption of—

Ore,		110,400 litres.
Charcoal,		1,104 charges.

To obtain the same quantity of metal by using the cold air blast, would have required 1,434 charges of the same charcoal.

There was, therefore, a saving of 330 charges, of which the value, at five francs per charge, = 1,650 francs,

Add eight days' work of the work-			
men, at 19.36 francs,	=	154.88	dollars.
		1804.88	= 360.98

Deduct for the expense of heating the air,

Attendance of fireman,	45		
21,500 kil. of anthracite,	516		
Interest, 10 per cent., on the cost of the			
heating apparatus,	41.10		
		602.10	= 120.42
		1202.78	= 240.56.

The benefit resulting from the employment of hot air was, for one month, 1202.78 francs, (\$240.56,) or 20f. 72, (\$4.14,) per 1000 kilog. (20 cwt.) of the casting produced. This is the minimum gain. Since, the general expenses are not given, and refractory mixtures of ores have frequently been used, during the month of June. It must be observed that the saving of 21,450 kilog. (42,900 lbs.) of charcoal, made in the casting, had required a consumption of 21,500 kilog. (43,000 lbs.) nearly an equal weight of anthracite, of which the value is much less than that of charcoal.

The tuyere was burnt through three or four times in twelve hours, an inconvenience which was remedied by surrounding it with water; after which, the working of the furnace became perfectly regular.

The sixth fire having been lighted, the temperature of the air was maintained at 130° R., (324° Fah.) and was sometimes raised above; but no change was found in the working of the furnace, nor could the charge be increased beyond 105 litres (3 $\frac{3}{4}$ cubic feet) of mineral, to 65 kilog. (130 lbs.) of charcoal.

The dimensions of the tuyere mouth, and the pressure of the air, were varied, and the results were always inferior to those already stated; so that the maximum effect produced, with the mixture of ores employed, was with a pressure of twenty-four inches of water,

a diameter of tuyere of twenty lines, the temperature of the blast, 130° R. (324° Fahr.) and 105 litres of ore to 65 kilogs. of charcoal.

A mixture of more refractory ores than the preceding, and which could not be smelted with the cold air blast, was reduced with much facility, but the charge of ore could not exceed 100 litres. It should be remarked, that the temperature of the blast, which appeared to give a maximum effect at temperatures not exceeding 130° R., was much below the temperature of melted lead, (604° Fahr.) to which it had been carried in the experiment made at Vienna in a coke furnace.

Remarks on the foregoing by the French Editor.

1. *M. Gueymard* has correctly observed, that unless the air can be heated by the flame which issues from the mouth of the charcoal furnace, those who are not able to procure a cheap combustible for the heating furnace, and continue to work with cold air, must be most unfavourably situated.

Happily, the attempts made in Germany, and the apparatus there contrived, and which has already been imitated in France, have shown that the flame which escapes from the furnace will heat to a proper temperature all the air which is required. It is recommended that at furnaces where charcoal is used, the heat which would otherwise be wasted, shall thus be used instead of the separate apparatus for heating air, thus augmenting the profits of smelting with heated air, by the whole value of the combustible consumed in the fires.

Thus at Rioupéroux, the saving which has been made of 1202.10 fr. will be carried to 1763.78 fr. per month, or to 30 fr. per 1000 kilog. of iron produced in place of 20 fr.

2. The best plan yet presented for heating the air by the flame at the top of the furnace, is the following, which differs a little from that employed at Wasseraufingen, and described by *M. Volz*. The air required for the blast, is passed through twenty small columns or vertical tubes, four feet long by two inches and a half in diameter, which are placed in a space or oven near the mouth.

By this means, the air is more heated and there is less friction, than by passing it through a long tube horizontally, because the air passes slower and has only four feet to traverse.

The diminution of the resistance to be overcome by the blowing machine is considerable and very important, because the water courses are frequently hardly sufficient, during the summer, to furnish the quantity of air necessary for the consumption of the iron furnaces.

3. The temperature of the air thrown into the furnace of Wasseraufingen, has been raised constantly to 165° R. (403° Fahr.) and often to 210° R. (504° Fahr.) with increased effect.

M. Gueymard, on the contrary, has observed that the production of iron was not augmented by an elevation of the temperature above 130° R. (324° Fahr.)

At Wasseraalengen, with the air heated to a temperature varying from 165 to 210° R. (329 to 400° Fahr.) to produce 1000 kilog. (2000 lbs.) of iron, 1130 kilog. (2260 lbs.) of charcoal was consumed, in place of 1730 kilog. (3460 lbs.) burned when the cold air was used. The weekly production has been carried from 527 local quintals to 734 quintals—equal to 357 metrical quintals, (lbs.)

At Rioupérourx, with the air heated to 130° R. (266° Fahr.) they have consumed, for 1000 kilog. (2000 lbs.) of castings, 1270 kilog. (2540 lbs.) of soft charcoal, in place of 1610 kilog. (3220 lbs.) with cold air.

The differences between the results obtained in these furnaces are not considerable. It is remarked that in both the quantities of charcoal consumed in twenty-four hours, is not augmented, but the charge of coal and the daily produce of casting, has, by the employment of the hot air blast, received a considerable increase.

[*Annales des Mines.*

REPORT

To the Board of Directors of Bridges, Public Roads, and Mines, upon the Use of Heated Air in the Iron Works of Scotland and England. By M. DUFRENOY, Engineer of Mines. Paris, 1834.

(Translated for this Journal, by S. V. Merrick.)

Some experiments by Mr. Neilson, Director of the Glasgow gas-works, led him to think that advantage would be gained by previously heating the air to supply the smelting furnace. He communicated his ideas to Mr. Mackintosh, long known for his inventive genius, and they united in undertaking at the Clyde Iron Works, in concert with Mr. Wilson, one of the proprietors of the establishment, a series of experiments to determine this important question.

In the first experiment, the air from the blowing machine was passed through a rectangular trunk of sheet iron, ten feet* long, four feet high, and three feet wide, where it was heated previous to its entrance into the furnace.

Notwithstanding the imperfection of this method, by which the temperature of the air could not be raised above 200° Fahr., it was evident from the experiment that the plan of Mr. Neilson was destined to produce a revolution in the manufacture of iron.

This first apparatus was soon destroyed by the action of the heat, and its renewal being very costly, they substituted a cast iron pipe, having in the middle an enlargement like the bulb of a thermometer.

This second apparatus produced beneficial effects; it lasted much longer, and the temperature of the air was raised by it to 280° Fahr. This increase, though small, produced a visible economy in fuel. Messrs. Neilson, Mackintosh and Wilson then understood the advantages which would result from raising the temperature many hun-

* English.

dred degrees. They abandoned this heating tube, and constructed a new apparatus, presenting a great number of tubes, heated in many points of their length. By this means, the temperature of the air was raised to 612° Fahr., a temperature above that of melted lead.

Though this temperature was much below that required for smelting iron, (estimated at about 1500°) it produced a considerable saving in the consumption of fuel. Another advantage was obtained, of great importance—that of being enabled to substitute crude coal for coke, without injury to the walling of the furnace. The quality of the iron was, on the contrary, improved, and the furnace which produced but little more than half its quantity of No. 1 and half of No. 2, when fed with coke, gave a proportion much greater of No. 1 iron, after the substitution of crude coal. Besides, the consumption of fuel was considerably diminished. This last circumstance was owing, probably, to the fact that the temperature of the furnace becoming higher, it was not necessary to add so great a quantity of flux to ensure the vitrification of the gangue which accompanied the mineral. It is probably owing to this elevation of temperature that coal may be substituted for coke.

The better to judge of the progressive increase of economy obtained at the Clyde Works, in the experiments to be noticed, we give for each of them the different consumptions of coal and flux.

In 1829. The combustion being maintained by cold air—

Coal.	1. For fusion, three tons coke,	t.	cwt.	qr.	
	corresponding to	6	13	0	
	2. For the blast engine	1	0	0	t. cwt. qr.
					7 13 0
Flux					10 2

In 1831. The furnace being in blast with air heated to 450 Fahr., they still burnt coke for the fusion of the metal—

Coal.	1. For fusion, 1 ton 18 cwt., cor-				
	responding to	4	6	0	
	2. For the heating apparatus	0	5	0	
	3. For the blast engine	0	7	0	
					4 18 0
Flux					9 0

In 1833¹ July. The temperature of the air was raised to 612° F., and crude coal used for fusion—

Coal.	1. For fusion	2	0	0	
	2. For the heating apparatus	0	8	0	
	3. For the blast engine	0	10	0	
					2 18 0
Flux					7 0

At this last epoch, the employment of heated air had augmented the yield of the furnace more than one-third, and consequently had effected a great saving in labour. In fine, the quantity of air required to maintain combustion in the furnace, was also found to be sensibly diminished. The blast engine of seventy horse power, which was sufficient in 1829 for only three furnaces, was found of ample power for the blast of four.

By comparing the results which will be indicated, it will be perceived that the economy in combustible is in proportion to the increase of temperature. As to the absolute saving, it varies in each furnace according to the nature of the coal, and the care used in carrying on the operation.

In spite of the complete success of these experiments, the introduction of heated air into the iron works encountered great difficulties. It was necessary to conquer not only the power of habit, but the prejudice generally existing, that the coal is sulphureous, and that its transformation into coke is not only favourable to combustion in the smelting furnace, but that it is indispensable to the making of iron of good quality.

This plan, in use four years in the environs of Glasgow, which it has saved from certain ruin, has scarcely passed the frontiers of Scotland. However, the wonderful advantages which it has produced, have begun to triumph over these prejudices, and gradually to extend its use in the different provinces of England. I know of twenty-one works containing sixty-seven furnaces, which work with hot air. In Scotland six; Flintshire one; Derbyshire three; Newcastle-on-Tyne two; Newcastle-under-Line two; Staffordshire five; Pontepool two.—Total twenty-one.

The iron made at these furnaces is generally No. 1, proper for casting the nicest work.

The plan is equally applicable to the metal intended for bar iron. To obtain this quality of metal, it is only necessary to change the proportion of fuel and mineral. The forges upon the *Tyne Iron Works*, near Newcastle—of *Codnor Park*, near Derby—employ for the manufacture of bar iron, none but the pig metal produced in the hot air furnaces.

In most of the establishments cited, the crude coal has been substituted in place of coke. In some works, where this substitution has not yet been adopted, they assured me, as at Monkland Iron Works, near Glasgow, that the temperature of the air was not raised sufficiently to enable them to pass from the manufacture by coke. In some others the quality of the coal being extremely bituminous, as near Newcastle, appeared to be an obstacle to the use of coal in the natural state.

The employment of hot air is not yet introduced into the great works at Merthyr Tidvil, Wales. The small consumption of coal which is employed crude, as I shall indicate at the close of this report, and the high price of the patent, has retarded its adoption—but I have no doubt that this plan will produce in this country a sensible saving in the consumption of fuel.

To appreciate the advantage which results from the employment of hot air, I shall give a statistical view of the works visited. I will describe the apparatus as far as they differ from each other; and I will compare the consumptions and expenses incident to the production of a ton of iron, before the introduction of hot air, and at present. This description will no doubt appear tedious, but in so important a question, and one which may have immense influence upon our forges,

I think nothing should be omitted tending to instruct our iron masters. I will then give some details upon the coals used in these works, and upon the expenses of manufacture in the Welsh works.

Finally, I will terminate the report by a recapitulation of the principal experiments which have been made in France to introduce the use of hot air in the iron works.

Before commencing this description, I should pay a just tribute of acknowledgment to the proprietors of the works which I have visited. Almost all have procured me, with a noble generosity, the means of studying their establishments with advantage. They have shown, in this circumstance, that the sole rivalry which exists between France and England is that of emulation.

[TO BE CONTINUED.]

¶ *Report on the Progress and Present State of our Knowledge of Hydraulics as a Branch of Engineering.* By GEORGE RENNIE, Esq., F. R. S., &c. &c.

(Continued from page 64.)

The first who had the happy idea of applying the law of Coulomb to the case of the velocities of water running in natural or artificial channels, was M. Girard, Ingénieur en chef des Ponts et Chaussées, and Director of the Works of the Canal l'Ourcq, at Paris.*

He is the author of several papers on the theory of running waters, and of a valuable series of experiments on the motions of fluids in capillary tubes.

M. Coulomb had given a common coefficient to the two terms of his formula representing the resistance of a fluid—one proportional to the simple velocity, the other to the square of the velocity. M. Girard found that this identity of the coefficients was applicable only to particular fluids, under certain circumstances; and his conclusions were confirmed by the researches of M. Prony, derived from a great many experiments, which make the coefficients not only different, but very inferior, to the value of the motion of the filaments of the water contiguous to the side of the pipe.

The object of M. Girard's experiments was to determine this velocity, and this he has effected in a very satisfactory manner, by means of twelve hundred experiments, performed with a series of copper tubes, from 1.83 to 2.96 millimetres in diameter, and from 30 to 222 centimetres in length; from which it appeared, that when the velocity was expressed by 10, and the temperature was 0, centigrade, the velocity was increased four times, when the temperature amounted to 85°. When the length of the capillary tube was below that limit, a variation of temperature exercised very little influence upon the velocity of the issuing fluid, &c.

* *Essai sur le Mouvement des Eaux courantes: Paris, 1804. Recherches sur les Eaux publiques, &c. Devis général du Canal l'Ourcq, &c.*

It was in this state of the science that M. Prony (then having under his direction different projects for canals,) undertook to reduce the solutions of many important problems on running water, to the most strict and rigorous principles, at the same time capable of being applied with facility to practice.

For this purpose, he selected fifty-one experiments which corresponded best on conduit pipes, and thirty-one on open conduits. Proceeding, therefore, on M. Girard's theory of the analogy between fluids, and a system of corpuscular solids or material bodies, gravitating in a curvilinear channel of indefinite length, and occupying and abandoning successively the different parts of the length of channel, he was enabled to express the velocity of the water, whether it flows in pipes or in open conduits, by a simple formula, free of logarithms, and requiring merely the extraction of the square root.†

Thus $v = -0.0469734 + \sqrt{0.0022065 + 3041.47 \times G}$, which gives the velocity in metres: or, in English feet,

$$v = -0.1541131 + \sqrt{0.023751 + 32806.6 \times G}.$$

When this formula is applied to pipes, we must take $G = \frac{1}{4} D K$, which is deduced from the equation $K = \frac{H + Z - H}{L}$. When it is applied to canals, we must take $G = R I$, which is deduced from the equation $I = \frac{Z}{L}$, R being equal to the mean radius of Dubuat

on the hydraulic mean depth, and I equal to the sine of inclination in the pipe or canal. M. Prony has drawn up extensive tables, in which he has compared the observed velocities with those which are calculated from the preceding formulæ, and from those of Dubuat and Girard. In both cases, the coincidence of the observed results with the formulæ is very remarkable, but particularly with the formulæ of M. Prony. But the great work of M. Prony is his "*Nouvelle Architecture Hydraulique*," published in the year 1790. This able production is divided into five sections, viz: Statics, Dynamics, Hydrostatics, Hydrodynamics, and on the physical circumstances that influence the motions of Machines. The chapter on hydrodynamics is particularly copious and explanatory of the motions of compressible and incompressible fluids in pipes and vessels, on the principle of the parallelism of the fluid filaments, and the efflux of water through different kinds of orifices made in vessels kept constantly full, or permitted to empty themselves; he details the theory of the clepsydra, and the curves described by spouting fluids; and having noticed the different phenomena of the contraction of the fluid vein, and given an account of the experiments of Bossut, M. Prony deduces formulæ by which the results may be expressed with all the accuracy required in practice.

In treating of the impulse and resistance of fluids, M. Prony ex-

† *Mémoires des Savans Etrangers*, &c. 1815.

plains the theory of Don George Juan, which he finds conformable to the experiments of Smeaton, but to differ very materially from the previously received law of the product of the surfaces by the squares of the velocities, as established by the joint experiments of D'Alembert, Condorcet, and Bossut, in the year 1775. The concluding part of the fourth section is devoted to an examination of the theory of the equilibrium and motion of fluids, according to Euler and D'Alembert; and, by a rigorous investigation of the nature of the questions to be determined, the whole theory is reduced to two equations only, in narrow pipes, according to the theory of Euler, showing its approximation to the hypothesis of the parallelism of filaments.

The fifth and last section investigates the different circumstances (such as friction, adhesion, and rigidity,) which influence the motions of machines.

A second volume, published in the year 1796, is devoted to the theory and practice of the steam engine. Previously to the memoir of M. Prony, "*Sur le Jaugeage des Eaux courantes*," in the year 1802, no attempt had been made to establish with certainty the correction to be applied to the theoretical expenditures of fluids through orifices and additional tubes. The phenomenon had been long noticed by Sir Isaac Newton, and illustrated by Michelotti, by a magnificent series of experiments, which, although involving some intricacies, have certainly formed the groundwork of all the subsequent experiments upon this particular subject.

By the method of interpolation, M. Prony has succeeded in discovering a series of formulæ applicable to the expenditures of currents out of vertical and horizontal orifices, and to the contraction of the fluid vein; and in a subsequent work, entitled "*Recherches sur le Mouvemens des Eaux courantes*," he establishes the following formulæ for the mean velocities of rivers.

When V = velocity at the surface,

and U = mean velocity,

$$U = 0.816458 V,$$

which is about $\frac{4}{5} V$.

These velocities are determined by two methods. 1st, By a small water-wheel for the velocity at the surface, and the improved tube of Pitot for the velocities at different depths below the surface.

If h = the height of the water in the vertical tube, above the level of the current, the velocity due to this height will be determined by

$$\text{the formula } V = \sqrt{2gh} = \sqrt[19.606]{\overset{\text{metres}}{h}} = 4.429 \sqrt{h}.$$

When water runs in channels, the inclination usually given amounts to between $\frac{1}{300}$ th and $\frac{1}{800}$ th part of the length, which will give a velocity of nearly $1\frac{1}{4}$ mile per hour, sufficient to allow the water to run freely in earth. We have seen the inclination very conveniently applied in cases of drainage, at $\frac{1}{1200}$ th and $\frac{1}{1300}$ th, and some rivers are said to have $\frac{1}{8000}$ th only.

M. Prony gives the following formulæ, from a great number of observations:

If U = mean velocity of the water in the canal,

I = the inclination of the canal per metre,

R = the relation of the area to the profile of its perimeter, we shall have

$$U = -0.07 + \sqrt{0.005 + 3233 \cdot R \cdot I};$$

and for conduit pipes,

calling U = the mean velocity,

Z = the head of water in the inferior orifice of the pipe,

L = the length of the pipe in metres,

D = the diameter of the pipe,

we shall have

$$U = -0.0248829 + \sqrt{0.000619159 + 717.857 \frac{D Z}{L}}$$

or, where the velocity is small,

$$U = 26.79 \sqrt{\frac{D Z}{L}}$$

that is, the mean velocities approximate to a direct ratio, compounded of the squares of the diameters and heads of water, and inversely as the square root of the length of the pipes; and by experiments made with great care, M. Prony has found that the formula

$$U = -0.0248829 + \sqrt{0.000619159 + 717.857 \frac{D Z}{L}}$$

scarcely differs more or less from experiments than $\frac{1}{40}$, or $\frac{1}{25}$. The preceding formulæ suppose that the horizontal sections, both of the reservoir and the recipient, are great, in relation to the transverse section of the pipe, and that the pipe is kept constantly full.*

In comparing the formulæ given for open and close canals, M. Prony has remarked that these formulæ are not only similar, but the constants which enter into their composition are nearly the same; so that either of them may represent the two series of phenomena with sufficient exactness.

The following formula applies equally to open or close canals:

$$U = -0.0469734 + \sqrt{\left(0.0022065 + 5041.47 \frac{D Z}{L}\right)}.$$

But the most useful of the numerous formulæ given by M. Prony for open canals, is the following:

* According to Mr. Jardine's experiments on the quantity of water delivered by the Coniston Main, from Coniston to Edinburgh, the following is a comparison:

	Scots Pints,
Actual delivery of Coniston Main,.....	189.4
Ditto by Eytelwein's formula,.....	189.77
Ditto by Girard's formula,.....	188.26
Ditto by Dubuat's formula,.....	188.13
Ditto by Prony's simple formula,.....	192.32
Ditto by Prony's tables,.....	180.7

Let g = the velocity of a body falling in one second,
 w = the area of the transverse section,
 p = the perimeter of that section,
 I = the inclination of the canal,
 Q = the constant volume of water through the section,
 U = the mean velocity of the water,
 R = the relation of the area to the perimeter of the section;

then 1st, $0.000436 U + 0.003034 U^2 = g I R = g I \frac{w}{p}$;

2dly, $U = \frac{Q}{w}$

3dly, $R w^2 - 0.0000444499 \cdot w \frac{Q}{I} - 0.000309314 \frac{Q^2}{I} = 0.$

This last equation, containing the quantities

$$Q I w \text{ and } R = \frac{w}{p},$$

shows how to determine one of them, and, knowing the three others, we shall have the following equations:

4thly, $p = \frac{g I w^3}{0.000436 Q w + 0.003034 Q^2}.$

5thly, $I = \frac{p (0.0000444499 Q w + 0.000309314 Q^2)}{w^3}.$

6thly, $w = 0.000436 \pm \frac{\sqrt{[(0.000436)^2 + 4 (0.003034) g R I]} Q}{2 g R I}.$

These formulæ are, however, modified in rivers by circumstances, such as weeds, vessels, and other obstacles, in the rivers; in which case, M. Girard has conceived it necessary to introduce into the formulæ the coefficient of correction = 1.7 as a multiplier of the perimeter, by which the equations will be,

$$p - 1.7 (0.000436 U + 0.003034 U^2) = g I w.$$

The preceding are among the principal researches of this distinguished philosopher.*

In the year 1798, Professor Venturi, of Modena, published a very interesting memoir, entitled "Sur la Communication latérale du Mouvement des Fluides." Sir Isaac Newton was well acquainted with this communication, having deduced from it the propagation of rotary motion from the interior to the exterior of a whirlpool, and had affirmed that when motion is propagated in a fluid, and has passed beyond the aperture, the motion diverges from that opening, as from a centre, and is propagated in right lines towards the lateral parts. The simple and immediate application of this theorem cannot be made to a jet or aperture at the surface of still water. Circumstances enter into this case, which transform the results of the prin-

* Recherches Physico-mathématiques sur la Théorie des Eaux courantes, par M. Prony.

ciple into particular motions. It is nevertheless true that the jet communicates its motion to the lateral parts without the orifice, but does not repel it in a radial divergency. M. Venturi illustrates his theory by experiments on the form and expenditure of fluid veins issuing from orifices, and shows how the velocity and expenditure are increased by the application of additional tubes; and that in descending cylindrical tubes, the upper ends of which possess the form of the contracted vein, the expense is such as corresponds with the height of the fluid above the inferior extremity of the tube. The ancients remarked that a descending tube, applied to a reservoir, increased the expenditure.* D'Alembert, Euler, and Bernoulli, attributed it to the pressure of the atmosphere. Gravesend, Guglielmini, and others, sought for the cause of this augmentation in the weight of the atmosphere, and determined the velocity at the bottom of the tube to be the same as would arise from the whole height of the column, including the height of the reservoir. Guglielmini supposed that the pressure at the orifice below is the same for a state of motion as for that of rest, which is not true. In the experiments he made for that purpose, he paid no regard either to the diminution of expenditure produced by the irregularity of the inner surface of the tubes, or the augmentation occasioned by the form of the tubes themselves. But Venturi established the proposition upon the principle of vertical ascension, combined with the pressure of the atmosphere, as follows:

1st, That in additional conical tubes, the pressure of the atmosphere increases the expenditure in the proportion of the exterior section of the tube, to the section of the contracted vein, whatever be the position of the tube.

2dly, That in cylindrical pipes, the expenditure is less than through conical pipes, which diverge from the contracted vein, and have the same exterior diameter. This is illustrated by experiments with differently formed tubes, as compared with a plate orifice and a cylindrical tube, by which the ratios in point of time were found to be 41'', 31'', and 27'', showing the advantage of the conical tube.

3dly, That the expenditure may be still further increased, in the ratio of 24 to 10, by a certain form of tube—a circumstance of which he supposes the Romans were well aware, as appears from their restricting the length of the pipes of conveyance from the public reservoirs to fifty feet; but it was not perceived that the law might be equally evaded by applying a conical frustrum to the extremity of the tube.

M. Venturi then examines the causes of eddies in rivers, whence he deduces from his experiments on tubes with enlarged parts, that every eddy destroys part of the moving force of the current of the river, of which the course is permanent, and the sections of the bed unequal; the water continues more elevated than it would have done if the whole river had been equally contracted to the dimensions of its smallest section—a consequence extremely important in the

* "Calix devexus amplius rapit."—*Frontinus de Aqueductibus*. See also *Pneumatics of Hero*.

theory of rivers, as the retardation experienced by the water in rivers is not only due to the friction over the beds, but to eddies produced from the irregularities in the bed, and the flexures or windings of its course: a part of the current is thus employed to restore an equilibrium of motion, which the current itself continually deranges. As respects the contracted vein, it had been pretended by the Marquis de Lorgna,* that the contracted vein was nothing else but a continuation of the Newtonian cataract, and that the celerity of the fluid issuing from an orifice in a thin plate, is much less than that of a body which falls from the height of the charge. But Venturi proved that the contraction of the vein is incomparably greater than can be produced by the acceleration of gravity, even in descending streams, the contraction of the stream being 0.64, and the velocity nearly the same as that of a heavy body, which may have fallen through the height of the charge. These experimental principles, which are in accordance with the results of Bossut, Michelotti, and Poleni, are strictly true in all cases where the orifice is small in proportion to the section of the reservoir, and when that orifice is made in a thin plate, and the internal afflux of the filaments is made in an uniform manner round the orifice itself. Venturi then shows the form and contraction of the fluid vein by increased charges. His experiments with the cone are curious, and it would have been greatly to be regretted that he had stopped short in his investigations, but for the more extensive researches of Bidone and Lesbros. M. Hachette, in opposition to the theory of Venturi, assigns, as a cause of the increase by additional tubes, the adhesion of the fluid to the sides of the tubes, arising from capillary attraction.

In the year 1801, M. Eytelwein, a gentleman well known to the public by his translation of M. Dubuat's work into German, (with important additions of his own,) published a valuable compendium of hydraulics, entitled "*Handbuch der Mechanik und der Hydraulik*," in which he lays down the following rules.

1. That when water flows from a notch made in the side of a dam, its velocity is as the square of the height of the head of the water; that is, that the pressure and consequent height are as the square of the velocity, the proportional velocities being nearly the same as those of Bossut.
2. That the contraction of the fluid vein from a simple orifice in a thin plate is reduced to 0.64.
3. For additional pipes, the coefficient is 0.65.
4. For a conical tube, similar to the curve of contraction, 0.98.
5. For the whole velocity due to the height, the coefficient by its square must be multiplied by 8.0458.
6. For an orifice, the coefficient must be multiplied by 7.8.
7. For wide openings in bridges, sluices, &c., by 6.9.
8. For short pipes, 6.6.
9. For openings in sluices without side walls, 5.1.

* *Memorie della Società Italiana*, vol. iv.

Of the twenty-four chapters into which M. Eytelwein's* work is divided, the seventh is the most important. The late Dr. Thomas Young, in commenting upon this chapter, says:

"The simple theorem by which the velocity of a river is determined, appears to be the most valuable of M. Eytelwein's improvements, although the reasoning from which it is deduced is somewhat exceptionable. The friction is nearly as the square of the velocity, not because a number of particles proportional to the velocity is torn asunder in a time proportionally short—for, according to the analogy of solid bodies, no more force is destroyed by friction when the motion is rapid, than when slow—but because, when a body is moving in lines of a given curvature, the deflecting forces are as the squares of the velocities; and the particles of water in contact with the sides and bottom must be deflected, in consequence of the minute irregularities of the surfaces on which they slide, nearly in the same curvilinear path, whatever their velocity may be. At any rate, (he continues,) we may safely set out with this hypothesis, that the principal part of the friction is as the square of the velocity, and the friction is nearly the same at all depths;† for Professor Robison found that the time of oscillation of the fluid in a bent tube was not increased by increasing the pressure against the sides, being nearly the same when the principal part was situated horizontally, as when vertically. The friction will, however, vary, according to the surface of the fluid which is in contact with the solid, in proportion to the whole quantity of the fluid; that is, the friction for any given quantity of water will be as the surface of the bottom and sides of a river directly, and as the whole quantity in the river inversely; or, supposing the whole quantity of water to be spread on a horizontal surface equal to the bottom and sides, the friction is inversely as the height at which the river would then stand, which is called the hydraulic mean depth."‡ It is, therefore, calculated that the velocities will be a mean proportional between the hydraulic mean depth and the fall, or $\frac{1}{10}$ ths of the velocity per second.

Professor Robison informs us, that by the experiments of Mr. Watt on a canal eighteen feet wide at the top, seven feet at the bottom, and four feet deep, having a fall of four inches per mile, the velocities were seventeen inches per second at the surface, fourteen inches per second in the middle, and ten inches per second at the bottom, making a mean velocity of fourteen inches per second; then finding the hydraulic mean depth, and dividing the area of the section by the perimeter, we have $\frac{50}{20.6}$, or 29.13 inches; and the fall in two miles

being eight inches, we have $\sqrt{(8 \times 29.13)} = 15.26$, for the mean proportional of $\frac{1}{10}$ ths, or 13.9 inches, which agrees very nearly with Mr. Watt's velocity.

* See Nicholson's translation of Eytelwein's work.

† See my "Experiments on the Friction and Resistance of Fluids," *Philosophical Transactions* for 1831.

‡ See Nicholson's *Journal* for 1802, vol. iii., p. 31.

The Professor has, however, deduced from Dubuat's elaborate theories, 12.568 inches. But this simple theorem applies only to the straight and equable channels of a river. In a curved channel, the theorem becomes more complicated; and, from observations made in the Po, Arno, Rhine, and other rivers, there appears to be no general rule for the decrease of velocity going downwards. M. Eytelwein directs us to deduct from the superficial velocity, $\frac{1}{130}$ for every foot of the whole depth. Dr. Young thinks $\frac{9}{10}$ ths of the superficial velocity sufficient. According to Major Rennell, the windings of the river Ganges, in a length of sixty miles, are so numerous as to reduce the declivity of the bed to four inches per mile, the medium rate of motion being about three miles per hour, so that a mean hydraulic depth of thirty feet, as stated to be $\frac{2}{3}$ ds of the velocity per second, will be 4.47 feet, or three miles per hour. Again, the river, when full, has thrice the volume of water in it, and its motion is also accelerated in the proportion of 5 to 3; and, assuming the hydraulic mean depth to be doubled at the time of the inundation, the velocity will be increased in the ratio of 7 to 5; but the inclination of the surface is probably increased also, and consequently produces a further velocity of from 1.4 to 1.7. M. Eytelwein agrees with Genneté,* that a river may absorb the whole of the water of another river, equal in magnitude to itself, without producing any sensible elevation in its surface. This apparent paradox Genneté pretends to prove by experiments, from observing that the Danube absorbs the Inn, and the Rhine the Mayne, rivers; but the author evidently has not attended to the fact, as may be witnessed in the junction of rivers in marshes, and fenny countries—the various rivers which run through the Pontine, and other, marshes in Italy, and in Cambridgeshire and Lincolnshire, in this country; hence, the familiar expression of the waters being overridden, is founded in facts continually observed in these districts. We have also the experiments of Brunings, in the "Architecture Hydraulique Générale de Wiebeking," Watmann's "Mémoires sur l'Art de construire les Canaux," and Funk "Sur l'Architecture Hydraulique générale," which are sufficient to determine the coefficients under different circumstances, from velocities of $\frac{2}{5}$ ths to $7\frac{1}{2}$ feet, and of transverse sections, from 1 to 19135 square feet. The experiments of Dubuat were made on the canal of Jard, and the river Hayne; those of Brunings, in the Rhine, the Waal, and Ifrel; and those of Watmann, in the drains near Cuxhaven.

M. Eytelwein's paper contains formulæ for the contraction of fluid veins through orifices,† and the resistances of fluids passing through pipes, and beds of canals and rivers, according to the experiments of Couplet, Michelotti, Bossut, Venturi, Dubuat, Watmann, Brunings, Funk, and Bidone.

* Expériences sur le Cours des Fleuves, ou Lettre à un Magistrat Hollandais, par M. Genneté. Paris, 1760.

† "Recherches sur le Mouvement de l'Eau, en ayant égard à la Contraction qui a lieu au Passage par divers Orifices, et à la Resistance qui retard le Mouvement, le long des Parois des Vases; par M. Eytelwein."—Mémoires de l'Académie de Berlin, 1814 and 1815.

In the ninth chapter of the "Handbuch," the author has endeavoured to simplify, nearly in the same manner as the motion of rivers, the theory of the motion of water in pipes, observing that the head of water may be divided into two parts, one to produce velocity, the other to overcome the friction; and that the height must be as the length and circumference of the section of the pipe directly, or as the diameter, and inversely as the area of the section, or as the square of the diameter.

In the allowance for flexure, the product of its square, multiplied by the sum of the sines of the several angles of inflection, and then by .0038, will give the degree of pressure employed in overcoming the resistance occasioned by the angles, and deducting this height from the height corresponding to the velocity, will give the corrected velocity.*

M. Eytelwein investigates, both theoretically and experimentally, the discharge of water by compound pipes, the motions of jets, and their impulses against plane and oblique surfaces, as in water wheels, in which it is shown that the hydraulic pressure must be twice the weight of the generating column, as deduced from the experiments of Bossut and Langsdorft; and in the case of oblique surfaces, the effect is stated to vary as the square of the sine of the angle of incidence; but for motions in open water, about $\frac{2}{5}$ ths of the difference of the sine from the radius, must be added to this square.

The author is evidently wrong in calculating upon impulse as forming part of the motion of overshot wheels; but his theory, that the perimeter of a water wheel should move with half the velocity of a given stream, to produce a maximum effect, agrees perfectly with the experiments of Smeaton, and others.†

* Hence, if f denote the height due to the friction,
 d = the diameter of the pipe,
 a = a constant quantity,

we shall have, $f = V^2 \frac{a l}{d}$ and $V^2 = \frac{f d}{a l}$.

But the height employed in overcoming the friction corresponds to the difference between the actual velocity and the actual height, that is, $f = h - \frac{V^2}{b^2}$, where b is the coefficient for finding the velocity from the height.

Hence we have, $V^2 = \frac{b^2 d h - d V^2}{a b^2 l}$ and $V = \sqrt{\frac{b^2 d h}{a b^2 l + d}}$

Now Dubuat found b to be 6.6, and $a b^2$ was found to be 0.0211, particularly when the velocity is between six and twenty-four inches per second. Hence

we have, $V^2 = \frac{43.6 d h}{0.0211 l + d}$, or $V = 45.5 \sqrt{\left(\frac{d h}{l + 47 d}\right)}$,

or more accurately, $V = 50 \sqrt{\left(\frac{d h}{l + 50 d}\right)}$

† The author of this paper has made a great many experiments on the maximum effect of water wheels; but the recent experiments of the Franklin Institution, made on a more magnificent scale, and now in the course of trial, elipse

The author concludes his highly interesting work by examining the effects of air, as far as they relate to hydraulic machines, including its impulse against plane surfaces, on syphons and pumps of different descriptions, horizontal and inclined helices, bucket wheels, throwing wheels, and, lastly, on instruments for measuring the velocity of streams of water. A very detailed account of the work was given in the *Journal of the Royal Institution*, by the late Dr. Young. But it is due to MM. Dubuat and Prony to state, that M. Eytelwein has exactly followed the steps of these gentlemen, in his "Theory of the Motion of water in open Channels."

[TO BE CONTINUED.]

¶ Composition of Chinese Gongs.

In the *Annales de Chimie* there is the following account of the Chinese process of manufacturing gongs and cymbals, translated by M. St. Julien, from the "Teen-kong-kae-weh," a Chinese Encyclopædia of Arts and Manufactures:—

"The red copper used in making musical instruments must be alloyed with mountain tin,* which does not contain a particle (*literally* a vapour) of lead. In order to make gongs, &c. eight pounds of copper are alloyed with two pounds of tin. If you wish to make little bells or cymbals, the red copper and the tin must be much purer and finer than for gongs.

"When a gong is to be made, it must not be cast in the form it is to have, and then forged with the hammer. You must begin by founding a thick sheet of metal, which must be cut round, and then beaten with the hammer. For this last purpose, the round sheet of metal must be spread upon the ground; and if the instrument is required to be of large size, four or five workmen must be placed around to hammer it. The sheet will spread out and enlarge under the hammer, and its edges will rise up. Then the instrument will begin to emit sounds resembling those of a musical cord. All these sounds proceed from the points which the hammer has struck (*literally* from the points struck by the *cold* hammer.) In the centre of this drum of copper, a boss or round elevation is formed, which is struck, and the blows of the hammer give it the tone. Two tones are distinguished in the gong—the *male* tone and the *female* tone. Both depend upon the rising being less or greater than ought to be given, with rigorous exactness to the boss, according as one or other is desired. By doubling the blows of the hammer, the instrument acquires a grave tone."

M. D'Arcet, in a note upon this translation, observes:—

"The only thing I find correct in this account is the composition

every thing that has yet been effected on this subject. See also Poncelet, "Mémoire sur les Roues Hydrauliques," and "Aubes Courbes par dessous, &c." 1827.

* The Chinese have two sorts of tin, mountain tin, and river tin; both are found in the provinces of Kwang-see.

of the alloy, of which the Chinese author states these instruments are formed. I have analysed seven gongs and twenty-two cymbals, and I have always found in one hundred parts about eighty of copper and twenty of tin. It is true, about five or six years ago, an original letter was communicated to me from a missionary, which stated that gongs contained, besides copper and tin, $\frac{3}{1000}$ of bismuth; but the properties of this alloy, and the result of the analysis just mentioned, show that the workman deceived the missionary on this point. I regard, then, as a fact proved, that these gongs and cymbals are composed of an alloy formed with eighty parts copper and twenty tin; but this is far from sufficient to enable us to fabricate these instruments; for this alloy is as brittle as glass, and if it be used as it comes from the crucible, it would be not only impossible to forge it, but even to use such instruments, merely cast with this alloy, without their breaking. This happened to an untempered gong, which was made at the school of Chalons for the King of Prussia, and to the gong at the opera, which, being cracked, was heated in order that it might be mended with silver solder. The alloy of eighty parts copper and twenty of tin, is so brittle, especially when hot, that it may be reduced to powder. This alloy has great density; its grain is very fine, and its fracture almost as white as that of bell metal. Chinese gongs and cymbals, on the contrary, have a small specific gravity, and a fibrous fracture exhibiting the colour of the alloy, of ninety parts copper and ten tin, used for cannon. Fragments of gongs and cymbals, far from breaking under the pestle, are malleable, and may, moreover, be bent till the two sides of the piece form together an angle of 130° or 140° without breaking. It follows clearly from this comparison, that gongs and cymbals cannot be fabricated, as the Chinese author pretends; that it is only by means of some peculiar process, some sleight of hand, that an alloy of eighty parts copper and twenty tin can be employed in this manufacture. The secret consists in tempering the alloy; in fact, when heated to a dull cherry red, and plunged into cold water, it takes instantly all the physical characters of the gong and cymbals. I have manufactured by this process upwards of sixty pairs of cymbals, and experience has fully justified what I have stated.

“Nothing is said in the Chinese account about tempering, yet, without this operation, it is impossible to fabricate these articles. As to the mode of making them, the alloy of eighty parts copper and twenty tin, even when tempered, cannot possibly be forced, and especially beaten out. All the Chinese author says about casting the alloy in the form of a plate, and beating it out with the hammer, is a mere fiction imposed upon him by a Chinese artificer, just as our artificers endeavour to mislead curious visitors in our manufactories. The following method is, in my opinion, the true one:—

“The model of the instrument is forged in red copper or brass. To this model is given exactly all the desired forms, by making the face of the hammer penetrate more or less on the two surfaces, so as to form that continuity of spherical hollows and salient parts we see upon cymbals, and especially gongs. When the model is finished,

it is employed to make a mould in sand, in putty, or in metal. An alloy of eighty parts pure copper, and twenty of fine tin, is prepared, which is run into an ingot; it is then re-cast, and run into the mould. The piece, when taken out of the mould, is rough-scraped; it is tempered as is done with steel. If it is mis-shapen, by plunging it red hot into cold water, the shape may be rectified by the hammer, and by flattening it with gentle blows. The required tone may be given either at first, by forcing the temper more or less, or afterwards by hammering. It is polished by means of a lathe, as is done with sauce-pans of copper or brass, and the instrument is finished."—*Asiatic Journal*.
[*Lond. Mech. Mag.*

¶ *Biographical Notice of the late Thomas Telford, Esq.*

Mr. Telford departed this life on the second of the present month, (September, 1834,) and his remains were deposited in Westminster Abbey on the tenth instant.

He was a native of Langholm, in Dumfriesshire, which he left at an early age. His gradual rise from the stonemasons' and builders' yard to the top of his profession, in his own country, or, we believe we may say, in the world, is to be ascribed not more to his genius, his consummate ability, and persevering industry, than to his plain, honest, straight-forward dealing, and the integrity and candour which marked his character throughout life.

His works are so numerous all over the island, that there is hardly a county in England, Wales, or Scotland, in which they may not be pointed out. The Menai and Conway bridges, the Caledonian Canal, the St. Katherine's Docks, the Holyhead roads and bridges, the Highland roads and bridges, the Chirke and Pont-y-cisilte aqueducts, the canals in Salop, and great works in that county, of which he was surveyor for more than half a century, are some of the traits of his genius which occur to us, and which will immortalize the name of Thomas Telford.

We know that he was inclined to set a higher value on the success which has attended his exertions for improving the great communication from London to Holyhead, the alterations of the line of road, its smoothness, and the excellence of the bridges, than on the success of any other work he executed; but it seems difficult to draw a line of distinction with any thing like nicety of discrimination, as to the degree of credit to which an engineer is entitled for ingenuity to plan, and the ability to execute, magnificent and puzzling improvements on the public communications of a great country. The Menai bridge will probably be regarded by the public, as the most imperishable monument of Mr. Telford's fame. This bridge over the Bangor ferry, connecting the counties of Carnarvon and Anglesea, partly of stone and partly of iron, on the suspension principle, consists of seven stone arches, exceeding in magnitude every work of the kind in the world. They connect the land with the two main

piers, which rise fifty-three feet above the level of the road, over the top of which the chains are suspended, each chain being 1,714 feet from the fastenings in the rock. The first three masted vessel passed under the bridge in 1826. Her topmasts were nearly as high as a frigate; but they cleared twelve feet and a half below the centre of the roadway. The suspending power of the chains was calculated at 2,016 tons; the total weight of each chain is 121 tons.

The Caledonian Canal is another of Mr. Telford's splendid works, in constructing every part of which, though prodigious difficulties were to be surmounted, he was successful. But the individuals in high station, now traveling in the most remote part of the island, from Inverness to Dunrobin Castle, or from thence to Thurso, the most distant town in the north of Scotland, will there, if we are not mistaken, find proofs of the exertion of Mr. Telford's professional talent, equal to any that appear in any other quarter of Britain. The road from Inverness to the county of Sutherland, and through Caithness, made, not only so far as respects its construction, but its direction, under Mr. Telford's orders, is superior, in point of line and smoothness, to any part of the road of equal continuous length, between London and Inverness. This is a remarkable fact, which, from the great difficulties he had to overcome in passing through a rugged, hilly, and mountainous district, incontrovertibly establishes his great skill in the engineering department, as well as in the construction of great public communications.

These great and useful works do not, however, more entitle the name of Telford to the gratitude of his country, than his sterling worth in private life. His easiness of access, and the playfulness of his disposition, even to the close of life, endear his memory to his many private friends.

[*Rep. Pat. Inv.*]

¶ *On the Resistance of Hollow and Solid Cylinders.*

If this question were proposed—which of two sticks, equal in length and cylindrical, is the easiest to break upon the knee—that which is entirely solid, or that which is hollow, having the same quantity of matter with the other? Most people would not hesitate to decide that the hollow stick would be the easiest to break. Nevertheless, the fact is quite the contrary. When we rest a stick upon the knee to break it, we rest it by some one of its points, and it is the point diametrically opposite which will take a circular motion about the point of support, while the fracture is made. Here, then, is a lever, and this point, which moves circularly, describes an arch so much the greater, as it is further distant from the point of support, or from the fixed point, and consequently, it has so much more force to resist the power which tends to make the fracture. A thicker cylinder, if solid, is the more difficult to break, not only because it contains more matter upon which we must act, but also because the diameter of its base is greater, and the extremity of its diameter, which moves in the fracture, is further distant from the fixed point.

If this cylinder, preserving the same quantity of matter, were hollow, it is visible that its total diameter, that is, the diameter as well of the hollow part as of the solid, would necessarily increase, and consequently only one of the causes which made its force and its resistance against being broken. Every hollow cylinder is, then, stronger than a solid cylinder, which has only the same quantity of matter; and this, according to all appearance, is one of the reasons why the bones of animals and the culms of corn and grass are hollow.

Galileo, the first philosophical inquirer into matters of this sort, has considered, in the solid and hollow cylinders, having their bases formed of the same quantity of matter, only the inequality of their diameters; and consequently, he has established, that the resistance of a hollow cylinder is to that of a solid cylinder, as the total diameter of the hollow one is to the diameter of the solid one. But this consideration is imperfect in this, that the extensions of the fibres of which the cylinders are composed, are not taken into account. These extensions, and consequently the resistances of all the particular fibres, continually increase from the fixed point to the most distant fibre, which must break first, and which we may suppose, is the greatest extension that it can suffer. It is the sum of all these unequal resistances that makes the resistance, which all the fibres together oppose to the power which tends to break them. Thus the total resistance of the cylinder depends upon three things,—on the quantity of matter that composes the base, on the resistance that all these fibres together bring to their extension, and on the magnitude of the diameter of the cylinder. There remains to determine and express geometrically these magnitudes; and it is this that M. Parent has done. The circles of the base of the solid cylinders must be made equal to the bands or zones of the hollow cylinders, and we must find the sum of the unequal resistances of all the fibres, which is a particular case of the general method of M. Varignon.

M. Parent having arrived at a general *formula*, which contains all the possible resistances of hollow cylinders, compared to the solid, has calculated upon this formula, a table, wherein he supposes that the total semi-diameter of a hollow cylinder is always 100 parts; and that the resistance of the solid cylinder, which contains in its base as much matter as the other, is also divided into 100 parts. We see by this table:—

1. That in proportion as the hollow cylinder, of which the *radius* can have but 100 parts of a certain determinate magnitude, has more void, and consequently less matter, it makes a greater resistance than the corresponding solid cylinder.

2. That this inequality of resistance always diminishes in proportion as the hollow cylinder is less hollow, and contains more matter: that, for example, a cylinder, of which the void is 99 *radius* and one in thickness, and which consequently answers a solid cylinder, which is only fourteen *radius*, has a resistance which is to that of the solid cylinder as 848 to 100, that is, as $8\frac{1}{2}$ to 1; and that the cylinder which has 50 in void and 50 in thickness, and which answers to a

solid cylinder of 87 *radius*, has a resistance which is to the solid one only as 121 to 100.

5. That the hollow cylinder of 99 void, the resistance of which, compared to that of the solid one, which is 14 *radius*, would be, according to Galileo, $7\frac{1}{7}$ times greater, has one $8\frac{1}{2}\frac{2}{5}$ times greater according to the hypothesis of M. Parent, which is also that of M. Mariotte.—*Abridged from the Transactions of the Royal Academy of Paris for 1702.*
[*Lond. Mech. Mag.*]

¶ *On the Effect of Impact on Beams.* By EATON HODGKINSON.

The author gave the results of some inquiries into the power of beams to resist impulsive forces. The experiments were made by means of a cast iron ball, forty-four pounds weight, suspended by a cord from the top of a room with a radius of sixteen feet. The ball, when hanging freely, just touched laterally an uniform bar of cast iron, sustained at its ends in a horizontal position, by supports under it and behind it, four feet asunder. The intention was to strike the bar, sometimes in the middle, and sometimes half way between the middle and one end, with impacts obtained by drawing the ball and letting it fall through given arcs, shifting the bar when the place of impact was to be changed, and obtaining the deflections of the bar at that place by measuring the depth which a long peg, touching the back of the bar, had been driven by the blow into a mass of clay placed there. The results were:—

1. The deflections were nearly as the cords of the arcs through which the weight was drawn, that is, as the velocities of impact.

2. The same impact was required to break the beam, whether it was struck in the middle, or half way between the middle and one end.

3. When the impacts in the middle, and half way between that and the end, were the same, the deflection at the latter place was to that at the former, nearly as three to four, which would be the case if the locus of ultimate curvature, from successive impacts in every part, was a parabola.

The preceding deductions the author had found to agree with theoretical conclusions, depending on the suppositions, (1) that the form of a beam bent by small impacts was the same as if it had been bent by pressure through equal spaces; and (2) that the ball and beam when struck, proceeded together after impact as one mass. These suppositions likewise gave as below:—

4. The power of a heavy beam to resist impact, is to the power of a very light one, as the sum of the inertias of the striking body and of the beam is to the inertia of the striking body.

5. The time required to produce a deflection, and, consequently, the time of an impact, between the same bodies, is always the same, whether the impact be great or small. The time, moreover, is inversely as the square root of the stiffness of the beam.

6. The results of calculations, comparing pressure with impact,

gave deflections agreeing with the observed ones, within an error of about one-eighth or one-ninth of the results.

[Report of 3d Meeting of Brit. Assoc. for Advanc. of Science.

On the Direct Tensible Strength of Cast Iron. By E. HODGKINSON.

The absolute strength of this metal, notwithstanding the extensive use made of it in the arts, is still a matter of doubt. If we turn for information to authors, we find Mr. Tredgold and Dr. Robison making it three times as great as Mr. Rennie, or Captain Brown, and the advocate of the greater strength (Tredgold) attributing the less strength, as found by the others, to the straining force not having been kept in the centre of the prism. For, supposing the extensions and compressions to continue always equal from equal forces, (which they are under slight strains,) a small deviation from a central strain would make a great reduction in the strength; and if the force were applied along the side of a square piece, the strength would be reduced to one-fourth. (*Tredgold*, Art. 61, 62, 234.)

The above contrariety of opinion was the cause of the following experiments, in which the utmost care was taken to keep the straining force along the centre of the castings, which had their transverse sections of the form +, except in the last two experiments, in which the section of the castings was rectangular, and the force applied exactly *along the side*. The iron was of a strong kind, the same as in the author's experiments on beams, (*Manchester Memoirs*, vol. v.) and was broken by a machine on Captain Brown's principle for testing iron cables.

Force up the middle.

Experiments.	Area of section in parts of an inch.	Breaking weight in tons.	Strength per square inch in tons.
1	3.012	22.5	7.47
2	2.97	21.0	7.07
3	3.031	25.5	8.41
4	2.95	19.5	6.59
			mean 7.65.
			Different quality of iron

Force along the side.

Experiments.	Area of section.	Breaking weight in tons.	Strength per inch.
5	4.83	11.5	2.38
6	4.815	13.75	2.855
			mean 2.62

Whence the strength of a rectangular piece of cast-iron, drawn along the side, is rather more than one-third of $7\frac{2}{3}$ tons, its strength, as above found, to bear a central strain (for $\frac{2.62}{7.65} > \frac{1}{3}$), but from the

preceding remarks, it ought only to be one-fourth; and, therefore, it would appear that a shifting of the neutral line had made the pieces capable of bearing a greater force along the side than in their natural state. [*Ibid.*]

¶ *Notice of a Method of Analyzing Carbonaceous Iron.*

At a meeting of the section of Mathematics and Physics of the British Association for the Advancement of Science, Professor Johnston gave an account of a new method of determining the amount of charcoal in the carbonaceous irons, by which he hopes to obtain results more precise and trustworthy than those arrived at by any former mode. This method consists essentially in reducing the iron to fine powder in a steel mortar, and burning it with oxide of copper. Mr. Johnston expects to be able to lay a series of results before the next meeting of the Association.

[*Ibid.*]

¶ *To purify Palm Oil, and to whiten it comparatively for making Soap.*

Take two parts of quick lime, and three parts of the muriate of ammonia, the lime having been previously slacked with half its weight of water, and allowed to cool, and reduced to a fine powder, and the muriate of ammonia having also been reduced to a fine powder, and then intimately blended with the powdered lime. The mixture is to be put into a still, or cast-iron pan, having a close cover to it, and a tube leading from the head of the pan, or still, to near the bottom of the soap copper, which should contain equal quantities of water and palm oil. On fire being applied to the still, the ammoniacal gas will pass over into the soap copper; and as the water and oil combine, continue adding boiling water to the extent of treble the weight of the palm oil in all. By this process, the colour of the palm oil will be almost instantaneously changed to a pale yellow. The boiling palm oil and water should, of course, be kept rapidly stirring while the gas is passing through. The ammonia being an alkali, adds to the strength and detergency of the soap, while the peculiar smell imparted by it is so weak as scarcely to be susceptible after a few days' exposure to the atmosphere.

[*Lond. Mech. Mag.*]

¶ *Patents issued in England.*

The whole number of patents for inventions granted in England, from the beginning of the year 1820, amounted to *one thousand four hundred and forty-one*; and of these, from accident, or other causes, known only to the patentees, the specifications of seventy-one have not been enrolled in chancery, as directed in each grant; consequent-

ly, no accounts of those inventions can be given. The patent rights, in those instances, have become null and void.

The following are the numbers of patents granted in the several years:

1820	granted	95	Specifications not enrolled	7
1821	"	115	"	5
1822	"	106	"	4
1823	"	136	"	2
1824	"	179	"	8
1825	"	247	"	15
1826	"	131	"	7
1827	"	150	"	6
1828	"	152	"	6
1829	"	130	"	11

[*Lond. Journ.*]

List of American Patents which issued in December, 1834.

A desire has been repeatedly expressed by persons interested in patents, that a monthly list should be published, bringing them up, as near as may be, to the period of publication. The editor has not thought it proper to publish his animadversions immediately after patents are obtained, that patentees might not charge the want of success of their inventions to the free remarks which he is in the habit of making upon them; such publications might also be injurious to those who wish to secure patents in Europe. These objections, however, do not lie to the mere titles of patents, and the names of patentees.

	<i>Dec.</i>
571. Propelling boats by a screw.—William Burk, Whitemarsh, Pa.	2
572. Saw mill dogs.—Phineas Bennet, Hector, New York,	2
573. Movable links.—Peter Barthlemy, New York city,	2
574. Cleaning grain, &c.—M. N. Armstrong and Wm. R. King, N. Y. city,	2
575. Moulding bricks.—Wm. C. Grimes, York, Pennsylvania,	2
576. Pressing bricks.—Wm. C. Grimes, York, do.	2
577. Carry-all.—Frederick Shelton, Jackson, North Carolina,	2
578. Nail and spike machine.—Henry Burden, Troy, New York,	2
579. Spinning reel.—Samuel McCawley, Fallston, Pa.	2
580. Making pitch.—Henry Ruggles, New York city,	2
581. Circular tenter bars.—Stephen R. Parkhurst, Meriden, Rhode Island,	2
582. Fireplace and stove.—Elias W. Newton, Middletown, Conn.	3
583. Tracks and wheels for rail-roads.—Ed. C. Hyde, Natchez, Miss.	3
584. Side saddle.—Olney Briggs, Schoharie, New York,	3
585. Covering ropes with caoutchouc.—Patrick Mackie, New York city,	3
586. Press for cotton, hay, &c.—I. Robinson, Portland, Maine,	17
587. Removing weights, unloading boats, &c.—Thomas Potter, Bowling Green, Kentucky,	17
588. Mortising machine.—J. H. Chandler, Worcester, Mass.	17
589. Wave motion for roving cotton.—L. Brewster, Poughkeepsie, N. Y.	17
590. Easy chair.—B. F. Hays, Pittsfield, Massachusetts,	17
591. Bedstead.—P. Humphreville and J. King, Morristown, N. J.	17
592. Thrashing machine.—C. P. Tenant and W. Eaton, Wooster, Ohio,	17

593.	Smelting iron ore.	Thomas J. Ridgway, Pottsville, Pa.	17
594.	Corn sheller.—	Warren Johnson, Boscawen, N. H.	17
595.	Cooking stove.—	James Childs, Henniker, N. H.	17
596.	Stone hammers, making.—	G. H. Pierce, Middleburgh, Mass.	17
597.	Lath machine.—	S. and C. Howard, Bristol, Mass.	17
598.	Lay for power looms.—	Benj. Brooks, New Market, N. H.	17
599.	Washing machine.—	Wm. C. Kniffin, Alexander, New York,	17
600.	Corn planter.—	Thacker O. Bush, Clark co., Kentucky,	17
601.	Dressing staves.—	Asahel Fairchild, Queensbury, N. Y.	17
602.	Ovens.—	Samuel S. Eaton, Mansfield, Connecticut,	17
603.	Sheet and boiler iron.—	John M'Nary, Brooklyn, New York,	17
604.	Scythes.—	Augustus H. Searle, Indianapolis, Indiana,	17
605.	Thrashing machine.—	Webber Furbish, Hallowell, Maine,	17
606.	Ovens.—	Benjamin Blaney, Boston, Massachusetts,	17
607.	Cotton seed, hulling.—	C. Beck and W. Jenks, Columbia, S. C.	17
608.	Wrought iron nails, &c.—	Wm. C. Grimes, York, Penn.	17
609.	Making do. from rods, &c.	do. do. do.	17
610.	Applying heat.—	John C. Douglass, New York city,	23
611.	Brick machine.—	Daniel Wolfe, Mount Vernon, Ohio,	23
612.	Mooring machine.—	Enoch Amblers, Root, New York,	23
613.	Bellows.—	John R. Morrison, Springfield, Ohio,	23
614.	Straw cutter.—	Joshua Moore, Roane county, Tenn.	23
615.	Shelling corn.—	Ezekiel W. Coffin, Gilead, Maine,	23
616.	Cheese curd cutter.—	Isaac Hunter, jr., North Braintree, Mass.	23
617.	Hemp dressing machine.—	Chandler E. Potter, Portsmouth, N. H.	23
618.	Stomach pump.—	Lemuel B. White, New York city,	23
619.	Splitting palm leaf.—	Charles Wadsworth, Barre, Mass.	23
620.	Planing and grooving.—	Z. B. Grover and D. Lawton, Springwater, New York,	23
621.	Planing machine.—	Thomas E. Daniels, Worcester, Mass.	23
622.	Safety lock.—	Zibeeon Wilbur, Woodbury, Conn.	23
623.	Pattern lathe.—	Henry Mellish, Walpole, N. H.	23
624.	Propelling boats.—	Isaac Theal, New York city,	24
625.	Bending tire and springs.—	Fowler M. Ray, Catskill, New York,	24
626.	Washing and churning machine.—	Nahum Swett, Readfield, Maine,	24
627.	Steel carriage springs.—	Lyman Gleason, Stafford, N. Y.	24
628.	Moulding bricks.—	Robert Rankin, Frankfort, Maine,	24
629.	Clapboard machine.—	Otis and Daniel Parker, Hubbardston, Mass.	24
630.	Horse power.—	William Emmons, New York city,	24

CELESTIAL PHENOMENA, FOR MARCH, 1835.

Calculated by S. C. Walker.

Day.	H'r.	Min.	
7	11	51	N. App. ♃ and 121 Tauri, ,6, ♃ S. 0',6
18	13	32	Im. 42 Leonis, ,6, N. 103° V156°
18	14	20	Em. N. 201° V254°

Meteorological Observations for December, 1834.

NOTE.—By an accident, the meteorological table for December has not been received in time to appear in the present number.

COM. PUB.

JOURNAL
OF THE
FRANKLIN INSTITUTE
OF THE
State of Pennsylvania,
DEVOTED TO THE
MECHANIC ARTS MANUFACTURES, GENERAL SCIENCE.
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

MARCH, 1835.

Remarks and Calculations on the Best Form for Railway Bars, and on the defects which exist in the present method of supporting the same. By R. STEPHENSON, Engineer.

(Concluded from p. 79.)

On a comparison of the chairs required for these two descriptions of rail, it will be found that they differ considerably in the depth of the recess for receiving the rail, that for the parallel rail being deeper, and the whole body of the chair higher, thus elevating the centre of gravity of the rail above the bearing surface at the bottom of the chair. Now, the chair for the elliptical rail is lower by a quantity equal to the swell of the rail, which of course brings the centre of gravity of the rail nearer to the bottom of the chair. This difference in the construction of the chair renders lateral blows less effective in straining it, and contributes much to the steadiness of the rail in the vertical position, supposing each fitted with equal care and accuracy.

When the period arrived for laying down the rails on the Newcastle and Carlisle Railway, a difference of opinion existed amongst the engineers consulted by the Board of Directors. This occasioned them to resort to actual experiment upon rails, expressly made by

the advocates of each class. They weighed 50 lbs. per lineal yard, and were designed of the form and dimensions deemed most suitable for such a trial, by each party. The following table describes each experiment, with every detail. The care taken throughout the experiments is evinced by the minutiae of the measurements, the deflexion being ascertained to be less than the $\frac{1}{1000}$ th part of an inch at every increase of load.

Experiments on the Comparative Strength of Different Malleable Iron Rails, October 10th, 1832.

Fish-bellied rail, length 15 ft. 9 3-4 inches, weight 262 lbs., equal to 49.3 lbs. per yard.						
Weights applied midway between bearings, in cwt.	Bearings in 3 ft., 0 15-16 in. apart.		Bearings, 6 ft. 0 5-8 inch apart.		Bearings, 3 ft. 9 3-16 inches apart.	
	Deflexion, 20 in. from one bearing, and 16 15-16 in. from the other.	Deflexion, 11 in. from one bearing, and 25 5-16 in. from the other.	Deflexion, 34 1-8 in. from one bearing, and 38 4-8 in. from the other.	Deflexion, 29 1-2 in. from one bearing, and 43 1-8 in. from the other.	Deflexion, 21 1-16 in. from one bearing, and 24 1-8 in. from the other.	Deflexion, 15 1-8 in. from one bearing, and 30 1-16 in. from the other.
20	2	2	17	17	5	4
34	4	4	43	38	9	8
48	6	5	63	60	15	14
62	9	8	89	81	21	19
76	12	11	112	94	29	25
90	16	14	121	110	35	31
104	19	16	156	144	42	36
118	22	19			48	41
132	25	21	Perm. Defl'n,	Perm. Defl'n,	56	46
146	28	23	12.	12.	63	54
160	32	27			69	61
174	35	29			76	68
188	37	30				
202	41	33			Perm. Defl'n,	Perm. Defl'n,
216	44	35			3.	3.
230	48	36				
	No permanent deflexion.					

Deflexion measured in 1088th parts of an inch.

Experiments on the Comparative Strength of different Malleable Iron
Rails, October 10th, 1832.

Parallel rail—length 15 feet 10 1-8 inches; weight 256 lbs. equal to 48.47 lb. per yard.						Fish-bellied rail, equal to 40.6 lb. per yard.		
Weights applied midway between bearings, in cwts.	Bearings, 3 ft. 0 15-16 inch apart.		Bearings, 6 ft. 0 5-8 inch apart.		Bearings, 3 ft. 9 3-16 inch apart.		Bearings, 3 feet 0 1-4 in. apart.	
	Deflexion, 20 in. from one bearing, and 16 15-16 in. from the other.	Deflexion, 11 in. from one bearing, and 25 15-16 in. from the other.	Deflexion, 34 1-8 in. from one bearing, and 38 4-8 in. from the other.	Deflexion, 29 1-2 in. from one bearing, and 43 1-8 in. from the other.	Deflexion, 21 1-16 in. from one bearing, and 24 1-8 in. from the other.	Deflexion, 15 1-8 in. from one bearing, and 30 1-16 in. from the other.	Deflexion, 20 inches from one bearing, and 16 1-4 in. from the other.	Deflexion, 11 inches from one bearing, and 25 1-4 in. from the other.
20	3	3	14	14	8	6	4	3
34	8	6	40	37	16	14	8	7
48	13	10	69	67	24	21	14	11
62	18	12	84	79	32	28	20	17
76	23	16	110	104	41	32	26	23
90	28	20	138	131	48	39	31	28
104	34	23	161	153	55	45	37	31
118	38	26			60	50	44	38
132	43	30	Perm. Defl'n, 4.	Perm. Defl'n, 3.	69	58	51	44
146	47	34			78	65	58	50
160	50	40			87	72	66	55
174	55	41			97	80	72	61
	Perm. Defl'n 3.	Perm. Defl'n, 2.			Perm. Defl'n, 9.	Perm. Defl'n, 8.	Perm. Defl'n, 6.	Perm. Defl'n, 4.

Deflexion measured in 1088th parts of an inch.

Deflexion measured in 1088th parts of an inch.

On examining the table, it will be seen that the deflexions were measured at a short distance on each side of the centre, between the bearings. This arose from the circumstance of the weight being applied at the centre, which, of course, rendered it inconvenient to apply instruments at that point for measuring the quantity of deflexion.

Without noticing the results at each addition of weight, as detailed in the table, which is sufficiently explanatory in itself, it may answer our present purpose to take the results indicated when that weight, which will probably be the maximum in practice, was applied, say 62 cwt. With this weight, the bearings three feet apart, and each rail equal to very nearly 49 lbs., the deflexion of the elliptical rail is to the deflexion of the parallel rail, as eighteen to thirty, nearly.

If the comparison of the other deflexions exhibited by the table be followed up, it will be found that they do not differ essentially from the above ratio.

If the weights producing permanent deflexion (or that point where the elasticity of the material is destroyed) be compared, it is scarcely less decisive; for we find that 174 cwt. produced a permanent deflexion of three in the parallel rail, whereas 230 cwt. did not reach this point with the elliptical rail.

Referring again to the table, there is only one other point to which I would beg particularly to direct attention, as it seems to corroborate what has previously been stated, respecting the impropriety of relying upon any ordinary railway bar for supporting the load, when the bearings are six feet apart. I allude to the deflexion which takes place with the weight of 62 cwt. placed on the parallel rail, when the distances between the bearings are increased to six, instead of three, feet. Here we find, at $34\frac{1}{8}$ inches from one bearing, and $38\frac{4}{8}$ inches from the other, the deflexion amounted to $\frac{8.4}{1088}$ of an inch, which, in round numbers, may be taken at one-tenth of an inch at the middle point.

Now, it must be borne in mind that this result is with a weight perfectly stationary, and, consequently, unassisted, in any way, by percussion; whereas, a similar load, moving on a railway, oscillates upon the springs of the engines, or carriages, and would produce an effect greater than $\frac{1}{10}$ th of an inch, but permanent deflexion would take place at considerably less than $\frac{2}{10}$ ths of an inch. We thus have it demonstrated, how essential it is to preserve the blocks at a uniform level with malleable iron rails, otherwise the texture of the iron must soon become permanently destroyed. It also proves how seldom we can take advantage of that which is said to be the chief advantage of the parallel rail, and that only when the railway is in improper order, in which case (as the experiments most distinctly prove) there will be great risk of permanent deflection.

This brings me to notice an apparent advantage which the parallel rail has over the elliptical rail, but which has never, to my knowledge, been adduced, or much insisted upon. In the parallel rail, any weight, when above a block, or support, is divided more equally over three supports than in the elliptical rail, owing to the greater flexibility of the latter immediately over each block, or sleeper. This, it must be confessed, appears to be a striking advantage; but it must be compared with the fact that, in cast-iron rails, where the flexibility of the rail is reduced to nothing, and where each support in succession bears the superimposed load, without transferring any portion

to the adjoining blocks, the expense of keeping the road in order is less than in malleable iron roads. Hence, it seems fair to conclude that the capability, in a rail, of transferring a portion of the strain to the adjoining blocks, is productive of injurious consequences, which are not adequately compensated for by this apparent advantage.

It is worthy of mention that this view of difficulties, or imperfections, arising out of having a number of bearings under one rail, is supported by a case in the construction of machinery, so nearly parallel, that it may be considered absolutely so, and fully appreciated by every practical mechanic. I allude to the difficulty and risk of placing more than two bearings under one axle-tree. It is found so difficult to keep such a construction in order, that it is scarcely ever adopted, and where the axle is long, it is generally divided into parts, making each bearing, and its portion of axle, independent. Now, this is precisely what is done in cast-iron railways; each support and rail has a duty to perform, which it does, independent of any other.

I am afraid this digression from the point more immediately under discussion, may appear irrelevant, but it is one which I feel is necessary, fully and clearly to explain the views expressed in the foregoing remarks, respecting the flexibility of the rails above the supports, which I hold to be beneficial in more respects than one; for, whilst the strength of the rail is rendered greater in the middle of its length, the height of the chair, and the level of the rail, is reduced, which contributes to the steadiness of the construction.

Having learnt that the elliptical rail on the Liverpool Railway had frequently broken, I wrote to Mr. John Dixon on the subject. The following is an extract from his letter:

"Our old rails, I am convinced, are too weak; not for the wagons, but for engines that bear six tons on one pair of wheels; and the weakest part is evidently the end next a joint, for although as deep at that point as at the places where the other chairs are fixed, it has not the support from the *next rail*, as if it were welded there, or were one continuous bar, especially when the joint chair gets loose on the block, key loose, and the block, or sleeper, itself settles. In fact, they generally bend, or break, within *six or eight inches of the end of the rail*. I believe the best rail for economising iron, would be to make all the rail undulating as usual, but the two extremes parallel, the parallel part to be as deep as the belly of the undulations; but probably this could not easily be made, and would be then only a substitute for a little more iron."

This intelligence induced me to ascertain, by calculation, the weakest point in the Liverpool rail, and compare it with Mr. Dixon's statement. If the calculation accorded with the practice, it is clearly easy to provide against a similar imperfection.

In the accompanying drawing,* figs. 1 and 2 are sections of the old Liverpool rail, weighing 35 lbs. per yard; figs. 3 and 4 are similar views of a proposed elliptical rail, to weigh 50 lbs. per yard. The

* The drawing here referred to did not accompany the manuscript from Mr. Stephenson.

relative strength of these two rails, at eight inches from the end, is as 6 to 15.3, or rather more than $1 : 2\frac{1}{2}$.

Such an increase of strength beyond those employed on the Liverpool and Manchester Railways, which were used for temporary purposes, and thereby injured, during the execution of the work, would appear to be ample.

If we apply the formula which has already been given for the strength of the rails, to the Liverpool elliptical rail, we shall find that it indicates the weakest point at about nine inches from the end, being, in fact, at that point of the curve where it deviates most from the true ellipse, which would have been equally strong throughout.

Now, the depth of the elliptical rail, at nine inches from the end, is exactly the depth due to a parallel rail of the same weight per yard. We have, therefore, data to calculate what would have been the strength of the parallel rail in the middle of its length, compared with the strength of the elliptical rail at that point, which has been found insufficient for six tons upon a pair of wheels, as stated in Mr. Dixon's letter.

The depth of the Liverpool rail, at the point of fracture may be taken at $2\frac{7}{8}$ inches; whereas the depth of a parallel rail of equal weight, would be three inches; the relative strengths of the two rails, at the usual place of fracture, would be $2\frac{7}{8}|^2 : 3|^2$, or as $8\frac{1}{4} : 9$, in favour of the parallel rail at this point.

Now, to continue the comparison, we must suppose the same load which broke the elliptical rail at seven inches from the end, transferred to the middle of the parallel rail, and calculate its adequacy under these conditions.

Since we find the elliptical rail break at seven or eight inches from the end, where the depth is $2\frac{7}{8}$ inches, we are perhaps near the truth in taking three inches as the proper depth, being the depth of the parallel rail, which we have just shown has the advantage over the other in the ratio of $8\frac{1}{4} : 9$.

We know also that the strain produced by the same weight, placed in different parts of a beam, is as the rectangle of the segments into which the beam is divided; the comparative strains, therefore, produced by a given weight, seven inches and eighteen inches from the end, will be as $7 \times 29 : 18^2$, or as $5 : 8$, very nearly.

Taking, therefore, the strength of the parallel rail as correct, at seven inches from the end, it must be too weak in the middle, in the proportion of 8 to 5; and we may, consequently, from these premises, draw the following conclusions, viz: Had the Liverpool Railway been laid with parallel rails, 35 lbs. per yard, the breakage would have been increased in the ratio of nearly $5 : 8$, and the place of fracture would have been midway between the bearings, instead of seven or eight inches from the end. If we take the weakest part of the elliptical rail, as calculation gives it, viz: nine, instead of seven inches, then the proportional breakage would have been as $6 : 8$.

I am fully aware that some risk is incurred in thus endeavouring to represent numerically a comparison which is perhaps not suscep-

tible of rigid calculation; but I am anxious that the truth on this much disputed point should be elicited, and in this attempt to establish a comparison upon grounds partly experimental and partly theoretical, it is believed a numerical statement will tend to define that which I am not aware has hitherto been more than mere matter of opinion, and thus bring the subject more within the grasp of legitimate argument.

In concluding these remarks, I beg leave to state that, if I have in any part of them, betrayed a bias in favour of the elliptical rail, without a sufficiently powerful reason, I shall have pleasure in hearing it pointed out, with a view to correction. I have endeavoured sincerely to give the subject that impartial consideration which its importance demanded, and I need scarcely add that it has given me some satisfaction to find that the experimental and theoretical results coincide sufficiently. This satisfaction is enhanced, when I find that the conclusion in favour of the elliptical rail is consistent with the opinion and experience of Mr. John Dixon, of the Liverpool and Manchester Railway—of Mr. Thomas Storey, the engineer on the Stockton and Darlington Railway—and of Mr. Nicholas Wood, one of the Directors of the Newcastle and Carlisle Railway, to whom I am indebted for the table of experiments embodied in these remarks. The circumstances which gave rise to these experiments have already been explained, and I am enabled, through the kindness of Mr. Wood, to add a copy of the report of the deputation from the Board of Directors of the Newcastle and Carlisle Railway, appointed to examine the subject by experiment. I also add copies of letters received from Mr. Wood and Mr. Storey.

COPY OF REPORT OF DEPUTATION ALLUDED TO ABOVE.

Result of trials made at Walker Foundry, Oct. 10th and 31st, 1832, to show the comparative merits of Fish-bellied and Parallel Rails.

“Various experiments were made, but those which appear to the committee to have more immediate reference to the views of the directors, are the following.

“Three trials were made of fish-bellied rails, of 50 lbs. per yard; three trials of parallel rails of the same weight, and two trials of fish-bellied rails, weighing 40 lbs. per yard.

“The weights laid on in these trials reached different amounts, but 90 cwt. is taken in the following for each trial, which the committee conceive to be a load sufficient to meet any practical object. The weight of the steelyard was 6 cwt., and 14 cwt. was added each time; the measure of deflexion was taken in parts, 1088 of which go to an inch.

“The first six loads (90 cwt.) on the three trials of 50 lbs. fish-bellied rails, measured $164\frac{1}{2}$ parts of deflexion, which give an average of 9.14 parts as the mean advance on each 14 cwt. loading.

"The first six loads (90 cwt.) on the three trials of 50 lbs. parallel rails, measured 230 parts of deflexion, or an average of 12.77 parts mean advance for each 14 cwt. loading.

"The first six loads (90 cwt.) on the two trials of 40 lbs. fish-bellied rails, measured 185 parts of deflexion, averaging 15.41 parts mean increase of each 14 cwt. loading.

"Rejecting fractional figures, the committee consider these results to show, under the circumstances stated, that a fish-bellied rail of 45 lbs. per yard is equal to a parallel rail of 50 lbs. per yard, because, as just expressed, nine parts represent the 50 lbs. fish-bellied rails, twelve parts the 50 lbs. parallel, and fifteen parts the 40 lbs. fish-bellied, bringing the parallel, as nearly as need be, midway between 50 lbs. and 40 lbs. fish-bellied rails."

(Signed,)

B. THOMPSON,
N. WOOD,
R. W. BRANDLING,
W. LOSH,
JAS. THOMPSON,
FRAS. GILES,
W. WOODS.

Copy of a Letter from Mr. Wood.

KILLINGWORTH, 24th May, 1834.

My dear Sir,—As the information you required was the result of private experiments, I did not like to give it until I had the sanction of the directors, which I now have. The experiments were occasioned by a difference of opinion whether parallel or fish-bellied rails were best, and, to bring the question before the directors in the most decisive manner, experiments were ordered to be made upon both rails—Mr. B. Thompson furnishing the section of parallel, and the fish-bellied being furnished by myself. Enclosed are the sections, by which you will see that the wearing surface, or top, of the rail, and the base, were precisely the same; the extreme depth of the parallel being 4 in., fish-bellied 5 in.; the base of the latter being a semi-ellipse, $3\frac{1}{2}$ in. deep, $1\frac{1}{2}$ in. from the end of each three feet, the curved knob being three inches. The experiments were conducted with the greatest care, and the deflexion measured in 1088th parts of an inch. The weights were added 14 cwt. at a time, upon 6 cwt., the weight of the steelyard.

Taking the first 96 cwt. laid upon the middle of the rail, the rail being supported at each end, the deflexion was $\frac{55}{1088}$ parts of an inch, fish-bellied; $\frac{77}{1088}$ parts of an inch, parallel, of 50 lbs. per yard each; and $\frac{98}{1088}$ parts of an inch 40 lbs. fish-bellied; although the conclusion come to by the directors was, that the parallel 50 lbs. was equal to

the mean between the 50 and 40 lbs. fish-bellied, viz: $\frac{55 + 98}{2} =$

76 $\frac{1}{2}$ 1; the comparative stiffness of 50 lbs. parallel and fish-bellied rails, was as 55 : 77.

As, however, the directors took every thing into consideration, the form of the two rails, the fact that the saving of material in fish-bellied being only in the keel of the rail, the conclusion that a 45 lbs. fish-bellied is equal to a 50 lbs. parallel, is, I believe, a just estimate of their comparative merits. We have found the circular knob an excellent form for securing a good material of iron, as it is difficult to form with the common iron. Any other information on the subject, I shall be happy to give you.

I am,

My dear Sir,

Yours, very truly,
(Signed,) NICH. WOOD.

To
ROBERT STEPHENSON, Esq.

Extract from Mr. Storey's Letter.

ST. HELEN'S, AUCKLAND, May 31, 1834.

DEAR SIR,—In reference to the subject of the form of rail best suited to railways. On the Stockton and Darlington Railway, you know we have only the fish-bellied kind, which form I have invariably supported, as the strongest, and best suited for railways, with the least weight of material in them, and liable to be the least affected by lateral blows, on account of the point of support being nearest the centre line of the mass of iron forming the rail.

One point is settled with me—that the better the quality of iron, the less it is suited for railway bars.

I have used rails made from Scrap No. 2 Mine Iron, with a Swede bar on the top; Cable Iron, manufactured into rails; No. 2 Mine Iron, do.; with none of which I am yet satisfied.

I have lately ordered 250 tons of rails (to replace our light ones) for the Stockton and Darlington Railway Company, to be manufactured in a different way; which, if I succeed in getting of the fish-bellied shape perfect, I am of opinion will be found to answer the purpose.

If I do not succeed in that shape (without faults and cracks on the under side) it is my intention to resort to the parallel rail, as of that shape there can be no doubt of its answering.

The process I have described is, that good strong mine iron is to be used, that has passed through the refinery and puddling furnaces, and reduced, under the forge hammer, from seven to five inches square, before rolling into rails. The price is only a shade higher than if manufactured from No. 2 mine iron *bars*, and 10s. per ton more than the parallel bar of the same quality and manufacture.

You will find that very heavy malleable iron rails are subject to rapid decomposition on the surface, until they attain the strength that passing weights will give motion to the particles, when that decomposition will, in a great measure, cease; thereby proving my

theory, that beyond a certain weight is a wasteful and useless expenditure.

Dear Sir,

Yours always, truly,

To (Signed,) THOMAS STOREY.
ROBERT STEPHENSON, Esq.

On the above report to the Directors of the Newcastle and Carlisle Railway, I have little to remark, except to explain the apparent discrepancy which would seem to exist, on comparing the results taken as the basis of the report, with those described by the table furnished to me by Mr. N. Wood. In the report, other trials were alluded to, with which the results are blended, so that the average is below those stated in the table. The other experiments were, I believe, varied by allowing the rails to be placed loosely on the supports, when the superiority of the elliptical rail, as regards stiffness, was not so decided. The table is founded on experiments, where the rail was firmly keyed into the chairs, and was, therefore, more nearly in the condition of a railway in perfect order. This, I apprehend, will account for the relative stiffness of the two rails being stated as 55 : 77, whereas calculation gives it 55 : 85, and, by the table, where the rail was firmly keyed to the supports, it is 55 : 91.

It is also necessary to explain that the elliptical rail was made with a circular projection, which fitted into a corresponding recess in the bottom of the chair, according to Mr. W. Losh's patent. This would render the keying more efficient, and add a little to the rigidity of the elliptical rail.

This may probably account for the stiffness by experiment sometimes exceeding that represented by calculation, which ought not to be the case where the form of the beam is reduced in depth towards the end. The comparative stiffness, however, taken from the average of the experiments, as stated in Mr. Wood's letter, viz: as 55 : 77, does not differ so much from 55 : 85, as to shake our confidence in the theoretical view affording means for a tolerably near approximation.

The relative ultimate strengths are not mentioned in the report, but from the table they may be found to be as 12 : 15, and calculation gives 12 : 16, which is again sufficiently near to show that the principles adopted in the calculations are correct.

In Mr. Storey's letter, he mentions, in a particular manner, the difficulties he has had with respect to the quality of the iron employed in making rails; and though he expresses it as his opinion, that "the better the quality of the iron, the less it is suitable for railway purposes," I am persuaded he intends this to be taken with great limitation, as it is evident he would not mean to convey the converse, viz: that the *worse* the quality of the iron, the *better* it is suited for railway purposes.

Mr. Storey is not alone in the opinion that the railway iron should not be of the best quality; it is urged by many that iron of the best quality is liable to laminate more rapidly than iron of a poorer de-

scription. I cannot say that my experience has led me to this conclusion; yet there may be consistency in rejecting the use of the finest cable iron, as not forming a rail proportionally stronger with the increased expense. I think it not improbable that much of the evil complained of on the Darlington Railway, from the lamination and splitting of the rails, may be owing, in some degree, to the circumstances of the carriages being without springs, and some of the very heavy locomotive engines with springs applied in such a manner, that they operate only to a partial extent.

On the Warrington and Newton, on the Liecester and Swannington, and on the Stanhope and Tyne, Railways, I recommended the rails to be made from *best No. 2 bar iron, entirely free from cinder*. The rails, when manufactured, are, therefore, No. 3 mine iron. This mode of manufacture would give rails of similar quality to those weighing 28 lbs. per yard, laid down on the Stockton and Darlington Railway in 1825, which, I was surprised to learn from the chairman, were in better condition now, after several years wear, than some rails of 40 lbs. per yard, recently laid down.

Experiments, made to determine whether Light exhibits any Magnetic Action. By JOHN W. DRAPER, *Christiansville, Mecklenburg Co., Va.*

(Concluded from page 85.)

It is not usually known, that so early as the time of Boyle, it had been ascertained, that a piece of amber would become electrified by exposure to the sunbeam, or even to the light of a fire. An experiment of this nature is explicitly detailed in his writings. I have verified the fact in the case of certain chrystals. A ruby from Ceylon, a rolled sapphire, a tourmaline, a Brazilian emerald, and a topaz, were each insulated on a fibre of gum lac, and exposed for a short time to the sunbeam. They were all found to be electrical, and would attract a very delicate fibre, at the end of an insulating handle, and then repel it. With a piece of amber the same result was not obtained, owing perhaps to the imperfection of the specimen. Now it may be said, that this development of electric tension, arose from the calorific action of the sunbeam, and was not dependant on any action of the light. But to this I answer, that when the same bodies were exposed to the action of heat, in the same degree, none of them gave any signs of electricity, except the tourmaline and the topaz, while the ruby, which was the most active in the sunshine, exhibited no attractive force.

It is extremely difficult to electrify a piece of glass by exposure to the sunbeam, so as to attract a hair or other light body. I noticed however, at certain times, that glass could be made to exhibit electric attraction, by exposure to the sun, but this was by no means a constant effect; the uncertainty depending chiefly on the proneness of the glass to become moist, and partly to the rigidity of the little electroscopic fibre. To remedy this, I had recourse to gold leaf, but un-

successfully. A leaf of gold has considerable inertia; it experiences much resistance to motion from the air, and besides is inconveniently unmanageable in such an experiment. Now if we could substitute for it any thing of less weight, and more perfect mobility, a more certain result might be obtained. It struck me, that a cloud floating in the atmosphere, was possessed of all those properties of which I was in search, extreme mobility and extreme lightness; but how to form such an arrangement was not so easy to contrive. At last I concluded to float a cloud of the vapour of iodine, in a close vessel of atmospheric air, which is of less specific gravity than the vapour, and has no chemical action upon it. The motions of such a cloud are easily discovered by its deep violet tint, and I expected as its particles were heavier than those of the atmosphere, which swam upon it, that it would accumulate on the electrified side of the glass, and displacing the air, pile itself against the surface.

Accordingly, I formed such a cloud, by means of heat, in a clear, dry tube of glass, and exposed it to a beam of light, coming through a hole in a dark chamber. The instant the light fell upon it, a far more energetic action than had been expected ensued. Instead of the cloud piling itself on the electrified surface, it precipitated itself upon it; was condensed by the powerful energy, and crystals instantaneously formed on the sunny side, in spite of its being the warmest.

Now, this power of disturbing the electric condition of glass ought not, upon the principles we have laid down, to be confined to any one of the rays of light in particular; it is a very property of matter, and, therefore, should be enjoyed by them all. This I found, by rigid experiments, to be the case. Admitting homogeneous rays, after passing through a hole in a screen, to fall upon the cloud, crystallization ensued in every case. But some might suppose that this deposition of crystals on the sunny side of a vessel, does not prove that surface to be electrified; it may arise only from some molecular action, taking place during crystallization. That such, however, is not the case, I was satisfied; for a drop of water being passed, on a piece of sponge, into a Torricellian vacuum, very shortly deposited a pearly dew on the sunny side, but no such action took place in darkness.

This deposition of crystals, on the enlightened, and, therefore, warm side of vessels, has long been an unexplained fact; it is noticed chiefly in vessels in which camphor is confined; it now receives an explanation. A piece of camphor being introduced into a Torricellian vacuum, perfectly dark, will not deposit crystals; but, if brought into sunlight, the tube is almost immediately coated with that odorous substance, on the enlightened side, and this action proceeds with very remarkable rapidity. Under the pressure of the atmosphere, it takes several days to produce the same effect. In like manner, that mercurial vapour which exists in a torricellian vacuum, deposits a metallic dew on the enlightened side in a short time; but the same result never follows in the darkness. I may remark, that all these depositions take place in direct opposition to what they should do, according to the doctrines of heat, for vapours ought to

condense on cold surfaces, not on warm; whereas, we find they totally disregard that law, and are uniformly deposited on the *nearest* enlightened surface.

But the same experiments which would teach us that such changes as these must, of necessity, take place in the electric equilibrium of the reflecting body, likewise shows that an analogous disturbance is effected in the electric equilibrium of each incident luminous particle; and if we direct our attention to this point, we shall find an extraordinary agreement between theoretical deduction and actual fact. When a particle of light falls upon the surface of a disk of glass, there is, conformably to those laws to which all matter is subject, an electric disturbance upon approximation, or contact. If the velocity with which the particle is moving, be sufficient to enable it to part from the surface by reflection, a change takes place on that reflecting surface, and likewise in the particle of light; that side of the particle which fell on the reflecting surface, becomes electrified, but, owing to its non-conducting power, the opposite side remains in a neutral state. Now, if this particle is received on another glass plate, the first reflection being made horizontally, and the second at right angles to it, or vertically, it is demonstrable that any other particle of light which follows the first, shall be so attracted by it, that a compound motion will ensue, in a resultant, whose path will differ from the true path of reflection; but that, if the second reflection be made horizontally, then no such effect shall ensue: in other words, if a ray of light fall upon a reflecting disk, at a certain angle, and fall again on another disk, so that the last reflection shall operate at right angles to the first, the ray shall become extinct; but if it be in the same plane, then shall the ray be reflected.

When a ray of light falls obliquely upon the plane surface of a transparent substance, it is solicited by certain forces, which draw it out of its former path, and cause it to pursue another, whose direction is entirely determined by the attractive power of the medium. But a certain portion of the ray is found to escape by reflection, and the angle which it makes with the surface of the medium is determined by its former angle of incidence. Now, as the attractive force of the medium acts at right angles to its surface, the effect produced upon the reflected ray is a maximum, when its path is at right angles to the refracted ray. I have formerly shown that these forces, acting at small distances, are of the same nature as capillary action, which may be referred to electricity; and it follows from this, that the greatest elastic disturbance takes place when the path of the reflected ray is at right angles to that of the refracted ray: in other words, under these conditions, light ought to be the more completely polarized, *and it is so*.

From these data, it would be easy to deduce the general laws of polarization of light, from the conditions of a maximum disturbance of the electric equilibrium; as, for instance, Brewster's law, that the index of refraction for any transparent body is the tangent of its angle of polarization. Thus, likewise, we establish the fundamental property of polarized light,—that when a particle of light has fallen

upon a medium, at an angle whose complement is equal to the angle of refraction, it becomes incapable of being reflected from a second surface at the same angle, provided the first reflection is operated horizontally, and the last vertically.

I content myself with having thus pointed out these remarkable coincidences; hereafter I shall consider the action which an interposed sheet of mica, or other crystallized body, has upon light thus electrified. With respect to the phenomena of diffraction, it equally supplies us with interesting results, and furnishes an explanation of the remarkable fact, that when diffraction is performed in homogeneous light, the fringes produced are alternately coloured and dark; coloured, when the differences of the length of their paths are as the numbers 2, 3, 4, 5—dark, when they are as the numbers $1\frac{1}{2}$, $2\frac{1}{2}$, $3\frac{1}{2}$, &c.; a key to the seeming paradox, that two rays of light may be so arranged, that, instead of producing an increased intensity, they shall co-operate, and yet produce darkness.

These experiments likewise lead us to several facts, which, in very delicate researches, may be noticed, though they do not commonly fall under the range of our observation. We may deduce from them that, when a closed vessel, containing air, or other gaseous matter, is exposed to sunshine, the pneumatic equilibrium of it is deranged; it is condensed towards the side which is exposed to the light; if it be a compound, whose parts will not bear compression, without experiencing chemical change, it may so happen that the mere condensation produced by the incident light, is sufficient to produce that change. Hence, a mixture of chlorine and hydrogen gas, exposed to the light, unites with an explosion; and hence it is, that the chloride of hydro-carbon, mixed with chlorine gas, is converted into per chloride of carbon, and muriatic acid is evolved; for the contraction of the glass condenses the mixture, until it gives out sufficient heat to cause combination, 148° Fahr. being sufficient to produce that effect.

NOTES OF AN OBSERVER.

Remarks on Professor Olmsted's Theory of the Meteoric Phenomenon of November 12th, 1833, denominated Shooting Stars, with some Queries towards forming a just Theory. By JAMES P. ESPY.

(Continued from p. 92.)

Having thus undermined the theory of the learned Professor, it would be temerity in me, as but few new facts have been brought to light, to propose one of my own; indeed I have none to offer. I have, it is true, incidentally shown some reasons for supposing that these meteors and the aurora borealis have one common origin—but what theory of the aurora, which has ever yet been advanced, will bear the test of a close examination, any better than the Professor's, concerning the meteors? The magnetic influence has been strongly advocated as connected with the aurora, because many auroral arches

have appeared in Great Britain nearly perpendicular to the magnetic meridian, and the streamers parallel to the magnetic dip; but this notion seems to be refuted by the fact, that *some* arches, even in Great Britain, and nearly *all* in this country, have had a very different bearing.

I may, perhaps, without theorizing, be permitted to turn the attention of meteorologists to a few queries on this subject, which I think worthy of further investigation than I have yet been able to give them.

1st. Do auroral arches always move towards some southern point?

2d. Do the streamers always lean in the direction of the motion of the arch?

3d. Is there always a sudden depression or elevation of the dew-point, about the time of a brilliant aurora?

The first two of these queries may be answered in the affirmative, so far as the observations of others have come within my knowledge; and the latter also, so far as my own observations have extended.

4th. Are clouds, or haze, in our latitude, generally formed behind the arch?

If this last query should, by future observations, be answered in the affirmative, it will account for the fact, that the aurora is more frequently seen, here and in England, in the north than in the south; for as the auroral light is always seen above the cloud which is near it, those who are north of the aurora, will be prevented from seeing it by the clouds or haze. Many facts have come within my knowledge which favour this idea.

I have frequently seen clouds accompanied with auroral light, pass from the north to south, and from west to east, with the light always above and in advance of the cloud, so that when the cloud had passed the zenith twenty or thirty degrees, it seemed to hide the light from view. One of the most remarkable instances of this kind occurred on the 17th of May, 1833. About nine o'clock, a brilliant aurora appeared low in the north. A few minutes after nine, beautiful streamers (not in motion) appeared rising into a clear sky, from a dense light below, which seemed to rest on dark clouds near the horizon. I watched it till within a few minutes of ten, and then, while I was taking notes, a bright arch was completely formed; and when I looked out again at ten, it was almost exactly in the zenith, for its southern edge was very near Alpha Lyræ, and it reached entirely across the heavens, in a direction about twenty degrees south of east, and as many north of west. It moved pretty rapidly to the south, and disappeared at twenty minutes past ten, about eleven degrees south of Lyræ. *During the whole time of my observation, clouds were constantly forming in the northern part of the heavens, so rapidly as to keep pace with the motion of the arch; all north of the arch being cloudy, and all south of the arch being clear; and when the arch disappeared, it did so as if it was by the intervention of the clouds.* The arch was about three degrees broad in the zenith, and certainly not more than a quarter of a degree near the horizon, and in the zenith the light was much less dense—it was a little bent at both ends, and had there something of the appearance of a ribbon, with its edge a little turned

towards the observer. The wind had been north in the morning, and changed round to the south-west below during the day; but there is reason to believe that an upper (not the uppermost) current was still coming from the north—the cloud certainly moved or *formed* in that direction, and I have frequently known a northern current above to continue to blow after the wind below had changed round even to the south. This arch was not seen at Wilmington, twenty-eight miles south-west of Philadelphia, though the aurora was.

Having mentioned the probability in this case, of an upper current of air from the north, I will propose here another query.

5th. Are there always two currents in different directions, at the time of aurora, and is the upper one generally from the north? Or where the upper and lower currents are in the same direction, from the north, does the upper move fastest?

There are several facts which lead me to suppose that this question may, by further observation, be answered in the affirmative. First, auroras generally commence low, and rise gradually to a higher elevation, which may as naturally be supposed to depend on a horizontal motion towards the south, as on a perpendicular motion upwards;—the same may be said of auroral arches, which most probably travel horizontally. Again, in many cases which have come under my own observation, these currents have been detected.

Besides, many meteorological phenomena can easily be accounted for, on the supposition of an upper current of air from the north, at the time of their occurrence, even when this current is not indicated by clouds.

I have known many instances, some when clouds were visible in the upper current from the north, and some when they were not visible, when the dew-point sunk to thirty-three and thirty-four degrees below the temperature of the air, and in one case to forty-one below. In most of these cases it was discovered by a sudden depression of temperature, (amounting, in one case, to 14° in an hour, with a change of wind to north, which occurred very soon after this great depression of dew-point,) that there had been a north current above, probably not many hundred yards from the surface of the earth, at the time of this depression.

The cause of these great depressions of the dew-point will readily appear, from what will be said hereafter of downward vortices, from the overlapping cold dry current. A small quantity of this cold dry air may, on descending, spread over a considerable surface of land, and thus coming in contact with warm ground, its temperature may soon be much increased, while its dew-point will continue low. It may be added, that the sudden fluctuations of the dew-point about these lines, favour this explanation.

Several phenomena also, which occurred on the thirteenth of November, and the day before, can be accounted for on the supposition that there was a cold north-west current above at that time. The dew point at one o'clock on the twelfth, was 57° Fahr., and at six in the evening, it was 40° . It rained a little during the day, the wind being south-west, but it was perfectly clear in the evening. Having seen many instances of so sudden a change, particularly a

depression of the dew-point, being succeeded by an aurora, I looked out for one that evening, but neither aurora nor shooting stars were visible as late as ten o'clock. There were no clouds in the upper stratum of air visible on the twelfth, but on the eleventh, the lower air was from the east, and the upper from the west, with rain, the dew-point being 37° . These fluctuations being so great and so sudden, I was not a little disappointed at finding not even the slightest appearance of an aurora.

Again, on the supposition of a cold current above, it is very easy to account for the sudden and violent gusts which occurred on the twelfth, and the night of the thirteenth of November. On the twelfth there was a gust in the Hudson, which upset a vessel, in which all hands were lost. On the morning of the thirteenth, there were several gusts of wind at New Haven, attended with an increase of meteors; and about eighty miles below Philadelphia, on the morning of the twelfth, about seven o'clock, so violent a wind blew directly from a cloud unusually round and well-defined, quite low, and apparently not more than *two hundred yards long*, that the Captain of the vessel was afraid the ship would drag her anchors. From this cloud, as was mentioned before, darted streaks of light similar to the aurora. Captain Parker also, in the Gulf of Mexico, had the wind blowing directly from the cloud in the north-east, round which the meteors were playing. It was stated before, that the equilibrium of the atmosphere in its ordinary state, is stable, because the upper strata of air certainly contains as much caloric as the lower, pound for pound—and probably a little more; but if we suppose a very cold current from the north-west to overlap a warm current from some southern point, to a great distance, or if we suppose the upper current from the north, to move much faster than the lower to the south, we may easily perceive that in this extreme case, the equilibrium becomes unstable, and many vortices may be formed, (of no great breadth,) of the cold air coming down from above, and of course making a violent current at the surface of the earth, in all directions outwards from the centre of the vortex, and consequently from the cloud, if one should be formed there. That a cloud should be formed there, in many instances, is highly probable; because the vapour surrounding the vortex would be mixed with the cold air of the vortex, and if there should be more than enough to saturate the compound, it would be condensed into a cloud. I acknowledge that in the case of the cloud seen down the Delaware, I have no proof that, to the west of that cloud, the wind blew from the east; but it is very certain that that cloud was very near to the observer, otherwise it would have been seen at Philadelphia; but it was not; neither was there any strong wind at Philadelphia at that time, nor so late as half-past ten o'clock. After that period I cannot speak from my own knowledge.

Now, if we suppose an upper current of very cold air, from the north-west or west, overlapping one of considerable warmth at that time, (and at Philadelphia the air at the surface of the earth, on the twelfth was actually seventeen degrees warmer than on the eleventh, and twenty-one degrees warmer than on the thirteenth,) it will most

satisfactorily account for these several phenomena—the sudden fall of the dew-point seventeen degrees on the afternoon of the twelfth—its fall of sixteen degrees more on the night of the twelfth—the sudden blasts which occurred at that time, caused by the downward vortices—the formation of a cloud in some instances, at the borders of a vortex, where the vapour in the surrounding atmosphere was sufficient in quantity to supersaturate the cold descending air, and the wind blowing from the vortex must necessarily blow from the cloud—the great change of temperature which occurred just before and just after—and, as the meteors have been demonstrated to be of atmospheric origin, and not gravitating bodies, perhaps I may be permitted to add, that the supposition of an upper very cold current, then existing, from the west or north-west, from which, in various places, vortices of small diameter might descend, will not only account for the gusts of wind observed by Mr Palmer, but also throw some faint light on the fact mentioned by him, that immediately after these blasts, the *number of meteors was increased*—for if the fifth query should, by further observation, be answered in the affirmative, it will then be rendered highly probable that the aurora is electrical, and depends on the overlapping of two currents of air of different electrical tensions, and consequently any thing which might bring these two currents into nearer proximity, such as the vortices spoken of above, would probably increase the development of electricity.

Nor is this probability very faint, when it is considered that almost all the clouds we hear of that night, were accompanied with a brilliant display of meteors, or auroral light, and some of them were highly luminous, as if the particles of condensed vapour of which they were composed, formed an interrupted conductor of electricity from one stratum to another, causing the electricity to appear in passing from one particle to another. And even when a cloud was not formed by one of these descending vortices, the vapour in the surrounding air not being enough to supersaturate it, yet the quantity of vapour in it must have increased by the proximity of the surrounding air of a higher dew-point, and thus its power of discharging its electricity would be increased. It need hardly be mentioned, that moist air is a better conductor than dry air.

I am well aware that these hypothetical speculations have but little weight with the true inductive philosopher. He inquires, is it a *fact* that there was an upper current on the night of the twelfth of November, from the north-west, overlapping a warmer current below—and by warmer here I mean containing more caloric to the pound—and has there never been an upper current of cold air overlapping an under one of warm air, since the Bonpland meteors of 1799?

I answer, I do not expect him to place more confidence in these speculations than I do myself, indeed not so much; for I have seen so many instances of the dew-point falling in consequence of an upper current from some northern point, of which many were accompanied with an aurora here, and many others with an aurora elsewhere, that

I confess I incline to the opinion that these two things are connected together as cause and effect.

But as to others, all I hope or expect by these speculations is to excite interest enough to induce them to observe *whether these things are so*. For this purpose, I will mention a few of the many cases in which I have observed the dew-point to fall immediately before and after the occurrence of an aurora. On the 8th of March, 1834, at half-past five o'clock in the afternoon, the dew-point was $59\frac{1}{2}^{\circ}$ Fahr., and at six o'clock, a shower having intervened, it had sunk fourteen degrees, and was then clear.

This was one of the most sudden falls I had ever seen, and I looked out with considerable anxiety for an aurora, and was a good deal disappointed at not being able, during the whole evening, to detect even the least appearance of one. Next morning, at sunrise, the dew-point was 15° above zero, having sunk $44\frac{3}{4}^{\circ}$ in $13\frac{1}{2}$ hours. The circumstance of no aurora being seen here, when there had been so remarkable a fall of the dew-point, shook my faith in the hypothesis; but it was strengthened again by discovering that the tail of Mr. Olmsted's comet had been seen on that night with uncommon brilliancy, by the Professor himself, at New Haven. He says: "This evening, the sky having been thoroughly cleared by a copious shower of rain, the luminous cone, or lens, reached nearly to the pleiades, through about 60° of long., and was visible till near nine o'clock." Again, from the afternoon of the 29th of March, 1834, to the morning of the 30th, the dew-point sunk from $47\frac{1}{2}$ to $9\frac{1}{2}$, and though it was clear in Philadelphia on both these nights, and the aurora anxiously expected, none occurred.

But here again the comet, or zodiacal light, of Mr. Olmsted, comes to our aid, and will not allow us yet to abandon our hypothesis. For he says: "On the 30th, it reached in a direct line from the sun between the pleiades on the west, and Aldebaran on the east, having its apex a little west of the latter, and making an angle with the ecliptic of seven and a half degrees, which is the inclination of the sun's equator, as has been observed heretofore respecting the zodiacal light."

Now, it is not a little remarkable, that immediately after this repeated appearance at New Haven, it begins to appear at Philadelphia, and as the Professor will be gratified to learn that the tail of his comet was seen beyond the neighbourhood of New Haven, I will for his gratification, as well as to show the existence of various currents, and rapid fluctuations of the dew-point, about that time, quote, verbatim, the words of my journal written at the time.

"On the 31st of March, during the whole day, there was a strong wind from the south-west. Notwithstanding the temperature did not rise above forty degrees, and the dew-point at one o'clock, was thirteen, having fallen from sixteen during the morning, the upper clouds were coming from the south-west as usual, the middle from the west all day, and in the afternoon at five o'clock, a lower stratum of clouds came up from the northern horizon, hiding from view in the north, the upper clouds of both strata, while, at the same time, the wind at the surface of the earth increased in strength from the

south-west. This lower current continued to blow till some time between eight and twelve on the second of April, when it changed to the north. In the mean time, the dew-point had gradually risen until the morning of the second, at eight o'clock, it was $56\frac{1}{2}^{\circ}$, some rain having fallen both on the first and second. All this time the middle current of clouds came from the west. On the afternoon of the second it began to fall, and in the evening, as soon as it was dark, an aurora was visible in the north-west, reaching from Orion's belt nearly to the northern horizon, at first not rising so high as the pleiades; but about nine o'clock, the pleiades were in the brightest part. At the same time there was a very faint aurora nearly in the east, its central part reaching as high as Spica Virginis."

The next morning, third of April, the dew-point had fallen to 24° , that is, 32° in twenty-four hours. During all this day, the air below came from the north, the middle from the west, and the upper from the south. As soon as dark, this evening also, the aurora appeared in the north-west, occupying the same place as on the preceding evening. It, however, rose higher in the latter part of the evening, and a few minutes before nine o'clock, it assumed exactly the appearance of the aurora described by Professor Bache, in the Journal of the Franklin Institute, vol. xiii., p. 1, with this only exception, that the pillars were not so straight and smooth, and they rested on a pretty dark cloud, which sloped downwards towards the horizon, which it reached exactly under Orion's belt. This cloud was much narrower at its northern end, where it was about 15° high, and under it was a dull auroral light, down to the very horizon. These pillars continued to rise nearly at right angles to a pretty strong north wind.

On the next day, the fourth, the wind was north-east, no change having taken place in the upper currents, and on the fifth, the wind continued very strong from the north-east, the upper current being from the south-west, and the middle veering from the west to the south. This night also, the aurora was seen between ten and eleven in the north-west; and the dew-point, although it had risen the preceding evening with the upper south wind, was down again on the morning of the sixth, to 15° .

I have not yet been informed whether these auroras were seen at New Haven, but Dr. Gibbons, of Wilmington, Delaware, who has watched the aurora very minutely for several years, says, in his Meteorological Journal, published in the Advocate of Science, that the aurora was not seen on any of these nights, nor indeed on any night of March, April, May or June. The inference here again appears to me inevitable, that these auroras could not be three or even two miles high;—how much lower we know not. Indeed, I find, by comparing Dr. Gibbons' Journal with mine, that of fifteen auroras which were seen at Wilmington, from the 10th of July, 1831, till the 15th of December, 1833, only two were seen at Philadelphia. In all these cases there is marked in my journal a sudden and unusually great change in the dew-point: twelve of them falls, and three rises. Of the three auroras corresponding to the three rises, one was the 17th of May, 1833, which was seen at Philadelphia, as a beautiful arch passing the zenith, at ten o'clock.

The dates of all these auroras should be mentioned here, but this paper has already been extended beyond the limits originally intended; and I must content myself with mentioning a few dates when there was a remarkable change of the dew-point here, but no aurora, in the hope that some persons who keep a meteorological journal to the north of this, may have the curiosity to examine whether an aurora occurred at any of those times or not, and publish the result of their examination, whether it shall be in the negative or affirmative. At all events, the comparison of these accounts, if published, will be highly interesting, and cannot fail to aid in the formation of a just theory in explanation of this meteor.

In 1832. January 26th; February 21st and 24th; March 14th, 18th and 27th; April 20th or 21st; May 21st and 27th; August 25th; September 5th and 23d; October 16th, 24th and 26th; November 14th and 20th; December 19th or 20th.

In 1833. January 11th or 12th, 16th and 26th; February 7th and 25th; March 2d; July 31st; August 8th; October 3d and 11th.

In 1834. January 3d or 4th, 13th and 21st; February 12th and 26th; March 3d, 8th, 21st or 22d, and 30th; April 11th and 27th; June 2d or 3d, 11th or 12th, and 27th; July 11th; November 16th.

At all these times there was a remarkable *depression* of the dew-point; but I have not had it in my power to ascertain whether the aurora was seen or not at distant places on these nights;—it was not seen at Philadelphia. It may be mentioned too, that in case the aurora was seen about these times, it was probably seen a little before them, in places north of Philadelphia; for I observe that when the aurora was seen about the same time at New Haven and at Philadelphia, it occurred a day or two sooner at New Haven than at Philadelphia, and that in like manner, it occurred sooner in one instance at Philadelphia than at Wilmington, Del.

This probability is increased from the fact, that the aurora, and especially auroral arches, are known generally to travel towards the south.

As there are no facts in opposition to the suggestions here made, and some, though not enough to found a theory upon, in favour of them, I am sure that even the rigid inductive philosopher will excuse me for throwing out these hints as worthy of further investigation.

(*To be continued.*)

Remarks upon the Employment of Pressure Engines, as a substitute for Water Wheels. By DANIEL LIVERMORE, Civil Engineer.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

The committee of the Institute have, by their accurate and valuable experiments, afforded the most satisfactory evidence that, under peculiarly favourable circumstances, water wheels may be so constructed and used as to ensure an *effective* application of three-fourths of the power applied for their propulsion; and from this, some me-

chanics have inferred that the present modes of applying water power admit of little or no improvement.

A more comprehensive view of the subject will, in the opinion of the writer, lead to a different conclusion. The following remarks are, therefore, offered in illustration of the probable advantages of substituting pressure engines for water wheels, in the propulsion of machinery, under various circumstances.

Before entering upon this subject, it may be proper to premise that the location of water power is generally such as to afford only a moderate amount of head and fall; and it may be assumed with tolerable certainty, that more than nine-tenths of the water power in the United States is confined to situations which do not afford an aggregate of ten feet, head and fall.

It is well known that, by the present modes of application, the *proportion* of power rendered effective is much less, with a moderate amount of head and fall, than in situations where the elevation is sufficient to admit the application to large overshot wheels, or other wheels, on which its action is continuous, by weight, or steady pressure, instead of the sudden effort of impact, whether derived from *direct* percussion, or by reaction; in the latter case, the greatest *effective force* found by actual experiment does not, as I am informed, exceed one-third of the power applied.

To simplify the subject, suppose, in *every* case, ten feet head and fall can be obtained for use. Then we will first consider it as applied to a pitch back, or breast wheel, both of which act upon the same *principle*, and are justly considered the most effective wheels for this amount of head and fall; yet, to prevent obstruction from flood water setting up the tail-race, it is generally expedient to leave $2\frac{1}{2}$ feet of fall, equal to one-fourth of the power, unappropriated. The remaining $7\frac{1}{2}$ feet head and fall, equal to seventy-five per cent. of the power, is further reduced by percussive action of the water at its introduction on the wheel; by its premature escape from the buckets; its retrograde action at its final delivery therefrom, and the retarding effects of centrifugal force, during its action on the wheel; so that not more than sixty per cent. of the power, *as applied*, is effective; or, taking into consideration the fall unappropriated, the *effective force* is only forty-five per cent. of the power.

2dly. If the water be applied to the best constructed reacting wheels, no loss is sustained by flood water, so long as the rise of water in the fore-bay is in the same proportion as in the tail-race; and the whole column may, in all cases, be brought to act, *in effect*, by percussion, and thus produce an effective application of force equal to one-third, or thirty-three per cent. of the actual power.

3dly. Undershot and tub-wheels are subject to obstruction by flood water, and if we leave $2\frac{1}{2}$ feet of fall unappropriated, there remains seventy-five per cent. of the power, which is applied percussively, and thus produces an effective application equal to twenty-five per cent. of the actual force.

4thly. Flutter wheels, of the description used for saw mills, are peculiarly liable to obstruction from back water, and it is generally

necessary to leave $2\frac{1}{2}$ feet fall, or one-fourth of the power, unappropriated, and the loss from percussive application of the remainder would reduce it to twenty-five per cent.; furthermore, at least one-third of the water escapes from these wheels without *any beneficial* action, leaving only about seventeen per cent. of effective force.

If we allow only one foot unappropriated fall, the calculations would give, for five feet head and fall, the same *proportional* results for the *effective force*, as before shown; but the *practical* result would be the stoppage of every wheel, except the reacting wheel, whenever there happened to be a superabundance of water.

In the application of water for the propulsion of pressure engines, the *whole column* acts by *weight*, or *pressure*, and the force is not diminished by flood water, so long as the rise at the outlet, or tail-race, does not exceed that in the fore-bay.

Pressure engines may likewise be constructed for use in situations where there is but a small quantity of water, and a greater amount of head and fall than can be applied to any single wheel; in such situations, these engines have been applied in Europe.

The engine which I have patented, under the denomination of the "Regulated Pressure Engine," is materially different in its construction, and adapted to situations affording but *small amount of head and fall*; this engine affords the means of adjusting the intensity of the force excited in either direction, so as to meet the resistance to be overcome principally in one direction, if required; or it may be equalized, and applied to produce a rotary motion, in like manner as is adopted for the steam engine.

This engine has the advantage over other pressure engines, in point of simplicity, and economy of construction,—affords more ample water way through the valves,—and so perfectly obviates the defect heretofore experienced from the non-elastic action of water, that, in a recently constructed working model, not the least concussion was observable from the action of the water, which was applied with between four and five feet head.

It must, however, be admitted, that this engine labours under the disadvantage attending all new machines on their *first* introduction, viz: the mechanical execution, in many of the minor details, will lack that accuracy of finish, and that due adjustment of the component parts, which are easily effected in the construction of machines to which thousands of ingenious mechanics have served a regular apprenticeship, and to the due execution of which they have for years devoted their whole attention. A full development of the advantages to be derived from the use of such engines, could not, therefore, be reasonably expected in their *first* construction. The first working model of this description being furnished with a piston six inches square, attached to a working beam, propelled a pump, having a plunger four inches square, with the same length of stroke as the engine, and so applied as to raise water from the outlet, or tail-race, into the fore-bay. Thus, if we make no allowance for leakage, the *effect* was equal to $\frac{1}{36}$, or a little more than forty-four per cent. of the force applied, and in this case the full force of the engine was not

excited; and, from the best calculation we could make, the *unexcited* force would exceed the most liberal allowance for loss from leakage, so as to leave the effect fully equal to forty-four per cent., after allowing for leakage and friction.

The head and fall applied to the breast wheels used at the Fairmount Water Works, as appears by a report of the Watering Committee in 1823, is eight feet six inches; and forty gallons, acting on the wheels, raise (after allowing for leakage) one gallon to the height of 96 feet: here the effect is $1 \times 96 = 96$; and the power, $40 \times 8\frac{1}{2} = 340$

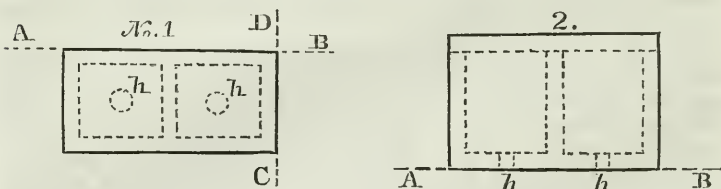
Thus, the *effect*, independent of leakage and friction, would but little exceed twenty-eight per cent. of the power, although applied to machinery exhibiting, in every part, evidence of consummate skill, and accuracy of workmanship.

Blairsville, Indiana county, Pa., Jan 1st, 1835.

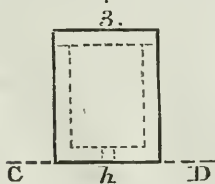
Notice of Hollow Bricks, used for the Construction of Arches.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—During a recent visit to Europe, I saw, at Toulon, buildings, the roofs of which were made fire proof, by the use of *hollow bricks*, making an arch so light as to be supported by walls of moderate thickness. I have not the means of giving exact information as to the dimensions of the bricks used by the French engineers, or the thickness of the walls by which the arches are sustained; but I think I can give a general notion of the manner of making these bricks, which will enable an architect to apply them, after a few trials, to any building to which they may be adapted; and I would particularly recommend the subject to the attention of the architect of the Girard College.



The form of the brick being that of a *voussoir* of an arch, except that the top and bottom are both made flat, suppose the dimensions of the upper surface to be ten inches by five inches, and the depth six inches, the radius of the arch twenty feet; agreeably to which supposition the subjoined drawings are made, allowing half an inch for the thickness of the material. Of the cuts, No. 1 is a plan of the brick, No. 2 an elevation on the line A B of the plan, and No. 3 an elevation on C D.



The mould will consist of a box, fitting the exterior shape, into which is pressed a former, having solid parts corresponding to those which are to be hollow in the brick; in this manner, the brick is formed without the top, which is made separately, and applied whilst wet; a hole (*h*) about three-fourths of an inch or an inch in diameter, punched in the bottom of each compartment, facilitates the drying and burning, prevents explosion by the expansion of the contained acid, and gives a better hold to the mortar in plastering on the arch, if necessary.

The quantity of material in a brick of the above dimensions, will be about 130 cubic inches, or less than half of that (296 cubic inches) in a solid one of the same dimensions; but it is probable that the weight of the bricks cannot be diminished in that proportion, because I apprehend that the dimensions given above are greater than it would be found advisable to use in practice.

Jan. 25th, 1835.

Facts in reference to the Spark, &c. from a long conductor uniting the poles of a Galvanic Battery. By JOSEPH HENRY, Professor of Natural Philosophy in the College of New Jersey, Princeton.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—The American Philosophical Society, at their last stated meeting, authorized the publication of the following abstract of a verbal communication made to the Society, by Professor Henry, on the sixteenth of January last. A memoir on this subject has been since submitted to the Society, containing an extension of the subject, the primary fact in relation to which was observed by Professor Henry as early as 1832, and announced by him in the American Journal of Science. Mr. Faraday having recently entered upon a similar train of observations, the immediate publication of the accompanying is important, that the prior claims of our fellow countryman may not be overlooked.

Very respectfully yours,

A. D. BACHE,

One of the Secretaries Am. Philos. Soc.

Philadelphia, Feb. 7th, 1835.

Extract from the proceedings of the stated meeting of the American Philosophical Society, January 16, 1835.

The following facts in reference to the spark, shock, &c., from a galvanic battery, when the poles are united by a long conductor, were communicated by Professor Joseph Henry, and those relating to the spark were illustrated experimentally.

1. A long wire gives a more intense spark than a short one. There is, however, a length beyond which the effect is not increased; a wire of 120 feet gave about the same intensity of spark as one of 240 feet.

2. A thick wire gives a larger spark than a smaller one of the same length.

3. A wire coiled into a helix, gives a more vivid spark than the same wire when uncoiled.

4. A ribbon of copper, coiled into a flat spiral, gives a more intense spark than any other arrangement yet tried.

5. The effect is increased, by using a longer and wider ribbon, to an extent not yet determined. The greatest effect has been produced by a coil 96 feet long, and weighing 15 lbs.; a larger conductor has not been received.

6. A ribbon of copper, first doubled into two strands, and then coiled into a flat spiral, gives no spark, or a very feeble one.

7. Large copper handles, soldered to the ends of the coil of 96 feet, and these grasped by both, one by each hand, a shock is felt at the elbows, when the contact is broken in a battery with one and a half feet of zinc surface.

8. A shock is also felt when the copper of the battery is grasped with one hand, and one of the handles with the other; the intensity, however, is not as great as in the last case. This method of receiving the shock may be called the direct method, the other the lateral one.

9. The decomposition of a liquid is effected by the use of the coil from a single pair, by intermitting the current, and introducing a pair of decomposing wires.

10. A mixture of oxygen and hydrogen is also exploded by using the coil, and breaking the contact, in a bladder containing the mixture.

11. The property of producing an intense spark is induced, on a short wire, by introducing, at any point of a compound galvanic current, a large flat spiral.

12. A spark is produced when the plates of a single battery are separated by a foot or more of diluted acid.

13. Little or no increase in the effect is produced by inserting a piece of soft iron into the centre of a flat spiral.

14. The effect produced by an electro-magnetic magnet, in giving the shock, is due principally to the coiling of the long wire which surrounds the soft iron.

FRANKLIN INSTITUTE.

Annual Meeting.

The annual meeting of the Institute was held at their Hall, on Thursday evening, Jan. 15, 1835.

JAMES RONALDSON, President, in the chair:

ROBERT LINDSAY, Recording Secretary, P. T.

The minutes of the last quarterly meeting were read and approved.

Donations of books were received from The Royal Institution of

London, The Royal Society of London, The Zoological Society of London, Wm. Carpmeal, Esq., of London, C. W. Pasley, C. B., Col. of Royal Engineers, London, The American Institute of the city of New York, and from Messrs. S. V. Merrick, L. Johnson, Adam Ramage, and S. C. Atkinson, of Philadelphia.

From Mr. Franklin Peale—A specimen of medal ruling, done in Paris.

From Mr. John Sartain—A mezzotint engraving of Wm. Penn.

From Messrs. E. & T. Fairbanks, of St. Johnsbury Plain, Vt.—A weighing machine.

From Mr. Richard Oakford—Specimens of copper ore, from South America.

The actuary laid on the tables the various periodicals received in exchange for the Journal of the Institute, during the last quarter.

Prof. Bache, from the Board of Managers, read their eleventh annual report, which was accepted, and referred, for publication, to the Committee on Publications.

The treasurer presented his reports for the last quarter, and for the year, which were read and accepted.

The chairman of the Committee on Science and the Arts, presented a report of the transactions of the committee during the past year, which had been drawn up by direction of the committee. The report having been read, was, on motion, referred to the Committee on Publications, for insertion in the Journal of the Institute.

On motion, the following resolutions were unanimously adopted:

Resolved, That a special vote of thanks from the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, be transmitted, by the Corresponding Secretary, to Henry Beaufoy, Esq., of London, for the valuable donation made to them of the nautical and hydraulic experiments, &c., by his late father, Col. Mark Beaufoy.

Resolved, That Mr. Beaufoy, by the publication of this work, has raised to the memory of his father, a monument which must transmit his name with honour to posterity.

The tellers reported the result of the annual election for officers and managers for the ensuing year, from which it appeared that the following gentlemen were duly elected, viz:

JAMES RONALDSON, *President.*

ISAIAH LUKENS, }
THOMAS FLETCHER, } *Vice Presidents.*

JOHN C. TRAUTWINE, *Rec. Secretary.*

ISAAC HAYS, M. D., *Corr. Secretary.*

FREDERICK FRALEY, *Treasurer.*

Managers.

Samuel V. Merrick,
 Abraham Miller,
 William H. Keating,
 Isaac B. Garrigues,
 Rufus Tyler,
 John Struthers,
 Matthias W. Baldwin,
 Mordecai D. Lewis,
 Charles H. White,
 Benjamin Reeves,
 Alex. Dallas Bache,
 Alexander Ferguson,

J. Henry Bulkley,
 John Wiegand,
 John Agnew,
 W. B. Reed,
 George Fox,
 Alexander M'Clurg,
 Robert Lindsay,
 Joseph S. Walter, Jr.
 Samuel Hufty,
 *John C. Cresson,
 *Charles Wetherill.

* New members.

Extract from the minutes.

JAMES RONALDSON, *President.*

ROBERT LINDSAY, *Rec. Sec. P. T.*

Minutes of the Board of Managers.

At a meeting of the Board of Managers, held at the Hall of the Institute, January 22, 1835,

GEORGE FOX, Esq., was elected Chairman of the Board; and

MESSRS. MATTHIAS W. BALDWIN, and FREDERICK FRALEY, Curators for the ensuing year.

And at a meeting of the Board, held January 28th, the chairman nominated the standing committees, agreeably to the by-laws. On motion, GEORGE FOX, Esq., was added to the committee on the library, and Mr. JACOB PEARCE, and Prof. HENRY D. ROGERS, to the committee on the cabinet of minerals; when the committees were appointed, as follows :

On the Library.

Mordecai D. Lewis,
 Isaac Hays, M. D.
 J. Henry Bulkley,

William B. Reed,
 Robert Lindsay,
 Charles Wetherill.

On the Cabinet of Models.

John Agnew,
 John Struthers,
 Charles H. White,

Joseph S. Walter, Jr.
 John C. Cresson,
 Charles Wetherill.

On the Cabinet of Minerals.

Isaiah Lukens,
 Abraham Miller,
 William H. Keating,
 John C. Trautwine,

Samuel Hufty,
 Jacob Pearce,
 Henry D. Rogers.

On Publications.

Alex. Dallas Bache,
Samuel V. Merrick,
Isaac Hays, M. D.

Matthias W. Baldwin,
Rufus Tyler,
John C. Trautwine.

On Premiums and Exhibitions.

Samuel V. Merrick,
Joshua G. Harker,
William H. Keating,
Frederick Fraley,

Isaac B. Garrigues,
Alexander M. Clurg,
Alexander Ferguson,
John C. Cresson.

On Instruction.

Frederick Fraley,
Matthias W. Baldwin,
Rufus Tyler,

John Wiegand,
John C. Trautwine.

On the Monthly Meetings of the Institute.

Samuel V. Merrick,
Alex. Dallas Bache,
Rufus Tyler,

Matthias W. Baldwin,
Benjamin Reeves,
John C. Cresson.

Managers of the Sinking Fund.

Samuel V. Merrick,
Frederick Fraley,

Alexander Ferguson.

Auditors.

Isaac B. Garrigues,

Joshua G. Harker.

Extract from the minutes.

GEORGE FOX, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

Annual Report of the Board of Managers.

The Board of Managers respectfully present to the Institute, their eleventh annual report.

The department of Instruction has been continued with the organization which was reported last year, with some modifications in its details, from which a beneficial influence is confidently anticipated. The Chemical instruction is still carried on by Prof. Mitchell, and the course now in progress is marked by that devotion to the interests of the institution, which has heretofore elicited the warm acknowledgments of the Board of Managers. The course will embrace many of the applications of chemistry to the arts, and be illustrated by suitable models, prepared under the direction, and at the expense, of our zealous teacher of chemistry.

The course of Natural Philosophy, under the charge of Prof. Johnson, is presenting to the class some of the most striking applications of physics, and is prosecuted with that assiduity which marks his character.

The evenings allotted to volunteer lectures have hitherto been

filled by Prof. H. D. Rogers, and J. P. Espy, Esq., who, in treating the branches of natural science to which they are devoted, are enlarging the boundaries of knowledge, and contributing to the best interests of the members of this institution.

The Drawing School is still under the charge of Mr. William Mason, with whom Mr. John M'Clure has been associated, as teacher of practical mechanical drawing; the united efforts of these gentlemen have placed the school in the first rank. The Board have in contemplation a plan by which the acquisitions in this school may be made to aid the model room, by requesting each pupil to deposit a drawing of some machine, or of mechanical tools and implements. By this means, useful emulation will be excited, and a valuable collection of proper objects of study be prepared for the use of young mechanics.

The English Evening School is continued by Mr. Seth Smith, whose indefatigable services the Board again acknowledge. Although this school has met with more favour than in previous years, it is far from enjoying that portion of public patronage to which it is entitled.

The Library is gradually increasing, two hundred and forty-six volumes having been added during the past year. Of these, thirty-two have been acquired by donation, forty-five by exchange of the Journal of the Institute, and one hundred and sixty-nine by purchase. The reading room has been numerously attended, and the books and periodicals forming the permanent and circulating portions of the library, are in constant use by many of our enterprising and industrious members. It is a subject of deep regret to the Board, that a more liberal appropriation to this department of the institution has not been within their power; but they console themselves with the reflection, that, like the other objects of the Institute, it is steadily and surely gaining in usefulness and strength. The collections of models and minerals are also gradually acquiring importance and system, and the models of new machines which will come into our possession by the administration of the Scott's legacy premiums, cannot fail to prove useful in an establishment pre-eminently devoted to the mechanic arts.

In compliance with a long cherished opinion of some of our most valuable members, who have believed that biennial exhibitions of the products of American industry would be found more advantageous to the manufacturer and mechanic than those held annually, no public exhibition has been held this year; but the monthly conversation meetings have furnished occasion for the display of such new inventions and improvements in existing manufactures, as the inventors, or makers, were desirous to present to public notice and examination. It is intended to hold an exhibition of domestic manufactures, under the auspices of the Institute, at the usual time, next autumn, and early measures will be taken to give public notice of this intention.

The Committee on Science and the Arts, constituted at the commencement of the year just past, now consists of sixty members, of whom seldom less than twenty are in attendance upon its meetings.

The combination of theoretical knowledge and practical acquirement in this committee, render it of important service to inventors, and this happy union may be confidently expected to aid the science and the arts of our country, by promoting investigations in their several branches. The committee have examined, by sub-committees, fifty different inventions, or subjects, which have been brought before them during the past year. In some cases, acting as counsellors to inventors, the results of their labours, though useful, are unseen by the public; in other cases, their reports, published in the *Journal of the Institute*, attest their activity. A portion of the subjects undertaken through the year, have not yet been examined to completion. The Board again call the attention of the ingenious, throughout the United States, to the existence of the Scott's legacy fund, from which premiums are due to the authors of useful inventions, or improvements, and which, under the direction of the committee just referred to, may be expected to be distributed, as desired by the testator, and by our city, impartially, and without unnecessary fastidiousness.

Intimately connected with the prosperity of mechanical science in our country, must be considered the support of a journal devoted to its best interests; and the members of the Institute, especially, should feel it their duty to promote the circulation of the *Journal* published under the auspices of the institution: in doing this, they may well feel a pride in the character and standing attained by this journal—a standing which cannot fail to elevate that of the mechanic arts, and of mechanics, in our country. The members should not lose sight of the fact that amusement is so frequently preferred to instruction, that the circulation of such a periodical requires effort on the part of the friends of true science.

Delays incident to the nature of one of the subjects of investigation undertaken by the committee, on the explosions of steam boilers, have hitherto prevented the completion of their report. These experiments, namely, on the strength of the materials used for steam boilers, are understood to be nearly, if not quite, completed, and it is hoped that their results will be communicated to the general committee, for the Institute, as soon as the other avocations of the members of the sub-committee may permit.

The experiments on water wheels have been already made public, and have gained for the Institute a meed of praise, which has been more unhesitatingly bestowed abroad than at home. The committee having charge of this subject have yet a portion of their labours to complete, and the Institute has a right to expect that their zeal will not be allowed to flag at the time when so much depends upon its exercise.

Since the last annual report, the Institute has received an increase of 157 members. Seven members have enrolled themselves as life subscribers, seventy-seven have resigned their memberships, and fifteen have died, leaving the present number of members 1724. The very moderate sum of three dollars per annum received from such as are not members for life, furnishes the entire reve-

nue by which the active energies of the Institute are sustained, the proceeds of the Journal being devoted exclusively to its improvement and support, and the other items of receipt being appropriated to the extinguishment of the debt contracted by the erection of the hall. The institution has been in operation upwards of ten years, and, during this period, has had to struggle with all those difficulties which mark the progress of most scientific undertakings; but, being formed on the basis of public utility, it has gradually risen superior to those difficulties, and has attained a height which must be most gratifying to its founders. The full development of its plan has removed opposition, and produced, in the public mind, a proper appreciation of its merits; and the rapid advance which it has made within the last four years, is mainly to be attributed to the facilities which it presents for the acquisition of useful knowledge, at a price within the reach of almost every member of the community.

The accommodations afforded by the present lecture room, have been proved, by the experience of two years, to be too limited, and it should be an object of primary importance with our successors, to take this matter into consideration. Although every other department of the institution sheds a beneficial influence on the character of the mechanics who are attached to it, the lecture room is the great school in which the objects of our association are to be carried out; and the future growth of the Institution must greatly depend on the increase of the accommodations which are there furnished.

Submitted by order of the Board of Managers.

(Signed,) ALEX. FERGUSON, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

Annual Report of the Committee on Science and the Arts.

In pursuance of the directions of the Committee on Science and the Arts, the following report of their transactions for the past year is respectfully submitted.

Since the organization of the committee, in February last, various subjects connected with the mechanic arts, and of very various grades of interest, have been submitted for examination, and have been referred to sub-committees for that purpose. By the rule of the committee, sub-committees are directed to hand their reports to the actuary within one week after their appointment, unless where the subjects before them require extended investigation; it is believed that a compliance with this rule has generally been aimed at, though, it must be confessed, not always with success. Of fifty improvements, or inventions, which have been laid before committees, reports have been made on forty-four. Of those which are not yet reported upon, a portion are such as require time to complete the examination. On the list of unfinished business, is that referred from the late Committee on Inventions, by the managers, to this committee, and relating to the premium offered, at the request of the Newcastle and Frenchtown Rail Road Company, for a plan for stopping the sparks which issue from the chimnies of locomotive engines, in which wood

is used as a fuel. This premium was offered in the list for the exhibition of domestic manufactures in 1833, and the inventions, in order to be entitled to compete for the premium, were to be submitted on or before October 1st, 1833. Several inventions were thus submitted, and, after examination, the late Committee on Inventions selected for trial such as they deemed most likely to answer the purpose designed; at the same time giving to all competitors the privilege of a trial of the apparatus described by them, if they still desired it, and furnished the apparatus. The sub-committee who have this matter in charge, reported, in March last, that measures had been taken to obtain the use of a locomotive, on Stephenson's construction, from the Germantown Rail Road Company; in June last, they reported that they had not received an answer to their official note, but had been promised the use of the locomotive of that rail road company, which was then under repair. In September last, this locomotive was understood to be still undergoing repairs. The postponement of the award of this premium is complained of by the competitors; but it is believed that the committee have done what was in their power, to execute the task imposed upon them. This subject may be thought worthy of reference to the General Committee.

The inventions, or improvements, brought before this committee, may be classed into those in which counsel, merely, is asked by the inventor, who withdraws his invention, if the sub-committee show reasons for an unfavourable opinion of it; and into those where the invention, patented or not, is brought before the public, independently of the opinions of the sub-committee. In both these cases, the practice of the committee has been uniform, although not regulated by resolution; when an invention is withdrawn, the sub-committee is, of course, discharged; when it is not withdrawn, but a report desired, the subject is brought, by this report, before the general committee, and a copy of the report, if adopted, is furnished to the inventor, by the actuary. When the subject has been considered by the committee of sufficient importance, the report has generally been ordered for publication in the Journal of the Institute, though on this point the committee have exercised a discretion. When the invention has been a patented one, the report of the sub-committee, when adopted, has been ordered for publication.

By an ordinance of our city councils, the award of the premiums and medals from the Scott's legacy fund, was vested in the Institute for seven years from February 27th, 1834; and by the managers of the institution, the duty of recommending such awards was confided to this committee. The regulations in regard to applications for these premiums, were published in our Journal, and in the newspapers of the day, and such publications will be continued by the standing sub-committee appointed for that purpose. By a late resolution of this committee, it has been made the duty of the actuary to furnish to all who may submit inventions to this committee, a copy of the regulations relating to the Scott's legacy premiums, and, by another resolution, sub-committees have been directed to

present such inventions as they may deem worthy of a premium, to the general committee. Notwithstanding the publications already made, the existence of this fund, and the liberal terms regulating the award of premiums from it, do not seem to be extensively known. By the words of the testator, the premiums were to be awarded to the ingenious, "who make useful inventions," and the rules throw no impediment in the way of merit.

Twelve models of specimens belonging to this legacy, and which have been received from the Committee of the Agricultural Society, who had charge of it, have been placed in the model room of the Institute.

A joint committee of members of this body, and of the American Philosophical Society, have been engaged in endeavours to promote the cause of meteorology, for the advancement of which so fine a field is open in our country. This they have judiciously done by directing attention to a set of observations, directed, as far as possible, to points which may be determined without the aid of instruments, namely, to the circumstances of wind, clouds, &c., attending on prevailing storms, their time of beginning, of ending, &c. It is to be regretted that the object of this circular has not always been understood, and that the additional remarks, intended for those who were willing to go further than this main object, have been interpreted as calling for a complete series of meteorological observations, which it was certainly not the intention of that committee to require from those who were willing to participate in their plans.

During the year there has been purchased, by subscription of members of this committee, and of others, a wind indicator, which, it is hoped, will, before long, be fixed up, so as to be seen in the reading room. The registry of the indications of this instrument will be very valuable for the objects proposed by the Committee on Meteorology.

In conclusion, it seems that the committee may congratulate themselves on the general usefulness of their labours during the past year, and that they have a right to expect, by a steady pursuance of the principles which have thus far guided them, that their sphere of usefulness will be much extended in years to come.

Very respectfully submitted.

A. D. BACHE, *Chairman.*

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. Philos Tyler's Shifting Gauge Cock.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination a Shifting Gauge Cock, for Steam Boilers, invented by Mr. Philos Tyler, of Philadelphia, REPORT:—

That this gauge cock consists of a tube, with a long, sweeping bend, which passes through a steam-tight collar, or socket, in the

head of the boiler. When this tube is made to revolve in its socket, the motion of the end in the boiler corresponds to that of a radius from the centre of the socket; so that, if its radial length be six inches, the orifice will describe a circle three feet in circumference, and command a vertical line in the boiler, one foot in length. The lever which turns the plug of the cock outside of the boiler, has, when it is parallel to the head of the boiler, the same radial direction and length as the tube within; so that, when applied to the head of the boiler, it will always indicate the position of the inner orifice of the tube.

The utility of this contrivance is obvious at a glance, as a momentary inspection will show that, by means of it, the elevation of the water in the boiler, and its condition, whether of increase or decrease, can be ascertained with the greatest accuracy. It also possesses the merit of simplicity, and fitness for practical application, and will generally enable a prudent engineer to avoid the danger arising from a deficiency of water in the boiler.

The committee deem this invention a fit subject for an award of the Scott's legacy premium, as it possesses both the requisites of novelty and utility, and therefore recommend to the Board of Managers the adoption of the following resolution, viz:

Resolved, That when the requisitions of the Committee on Science and the Arts, with respect to the Scott's legacy premiums, are complied with by Mr. Philos Tyler, the award of a premium and medal be made to him, for his invention of a shifting gauge cock for the boilers of steam engines.

By order of the committee.

WILLIAM HAMILTON, *Actuary.*

November 13th, 1834.

Report on Mr. James D. Woodside's Perambulator.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination, a machine invented by Captain James D. Woodside, of Washington city, D. C., for ascertaining the rate of a vessel's motion through the water, REPORT:—

That they have had the same under their examination. This machine, called a Perambulator, consists of several parts, which we will endeavour to describe. First, the water wheel, about four inches in length, and twelve inches in circumference, (proposed to be graduated by actual experiment,) made with four wings, or floats, fixed on pivots, and so constructed that their flat surfaces are exposed to the action of the current when in a certain position; and during the revolution of the wheel, they move on their pivots, and present their edge, when opposed to the motion of the current. This wheel is inserted one-half its diameter into the stern post, about two feet below the water line, when the vessel is light, so as not to be affected by the motion of the water at the surface; on the axis of this

wheel, which is vertical, is an endless screw, driving a wheel containing 132 teeth, whose axis lies horizontal, and on which is a screw, driving a wheel with sixty teeth, placed on a vertical shaft, and extending up the stern post to the cabin, or other convenient place, on which is a screw, driving a wheel with forty teeth, placed on a horizontal axis, passing through the dial, and carrying a hand which indicates the distance, in miles, that the vessel has run. One revolution of the last mentioned wheel is sixty miles, corresponding with the divisions on the dial.

The principal feature of Captain Woodside's machine, and on which he rests his claim of novelty, is the peculiar form of his water wheel, with the movable wings, or floats; he has been anticipated in the application of the same principle to windmills.

One objection presents itself to the minds of the committee, viz : a vessel going at the rate of ten miles per hour, would require the water wheel to make 880 revolutions per minute, and the probability is, that in a short time, running with such velocity, the wheel would be rendered useless, by wear; therefore the committee cannot, with confidence, recommend the above described machine. There may be practical difficulties that they cannot foresee; although there have been machines nearly similar attempted at various times, they have never come into general use.

As experience is the best criterion to test the utility and durability of this machine, we think it worth a trial, it not being attended with much expense, and being a great desideratum with navigators to have an instrument that would indicate the true distance the vessel has passed over.

By order of the committee.

WILLIAM HAMILTON, *Actuary.*

Nov. 13th, 1834.

Report on Mr. Thomas Hutchings' Hydraulic Apparatus.

The Committee on Science and the Arts, constituted by the Franklin Institute, of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination, by Mr. Thomas Hutchings, of Reading, Berks county, Pennsylvania, a new principle of action, and machine designed to put it in operation, REPORT:—

That they have examined Mr. Hutchings' drawing, descriptive of a machine, the action of which is to be derived by the agency of what he terms a power wheel, which is to be propelled by means of "balls of wood, or some other floating substance," applied at, or near, its virtual centre, on which they are to act by gravity, similar to that of water on an overshot water wheel, and when the balls successively arrive at the bottom of the wheel, they are to be conducted into a vessel, to which is attached a tube, of such capacity as fully to admit the balls to pass through it; which tube is to extend to the top of the wheel; the vessel and tube are to be filled with water, and when the

balls are forced into the vessel, they are to ascend through the tube, by their float power, to its top, whence they are again to be applied to the wheel; thus Mr. Hutchings supposes the wheel will be set in motion, and its action continued, requiring only a small quantity of water supplied to the tube, equal to the evaporation, and what may be carried off by the balls, in passing from it to the wheel. Your committee deem it unnecessary to describe in detail the machinery by which Mr. Hutchings proposes to conduct the balls into the vessel at the bottom of the wheel, or the water to the top of the tube, believing that the failing of the supposed action will be apparent, by simply stating that more power will be required to force these balls into the vessel, against the head of water contained in the tube, than their gravity can effect in descending through the same perpendicular space on the wheel.

It is evident that the *quantity* of power required to cause each ball to enter against an opposing head of water, will be in proportion to its bulk, whilst its effect to turn the wheel will be as its weight only. Hence, if balls of half the specific gravity of water be used, more than double the *quantity* of power will be required to force them into the vessel, than can be reproduced by their action on the wheel.

Had the inventor proposed to inject water into the vessel, thus causing a similar quantity to flow from the top of the tube to a well constructed water wheel, his object would have been more nearly approached than it can be by means of his balls; *either* of those modes, however, will fall far short of producing and maintaining the motion of the machine itself, much less of effecting any useful purpose.

By order of the Committee.

WILLIAM HAMILTON, *Actuary.*

Jan. 8th, 1835.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN AUGUST, 1834.

With Remarks and Exemplifications, by the Editor.

1. For a *Cooking Stove*; Horace Bartlett, Carmel, Putnam county, New York, August 1.

The claim in this patent is to the "extending the bed of the fire so far back that it receives long wood, in such a way that only about one-half of it is burning at the same time, unless the draft door is opened at the back, which may be done when more heat is required; thus putting in long wood, and leaving it perfectly under the control of the manager, consuming no more than what is required for immediate use, thereby saving the expense of cutting the wood into short pieces; thus acting somewhat like the principle of burning coal from the base, but applied to wood for a cooking stove."

The description given of this stove is very imperfect, but it is very well represented in the drawing; and, according to this, the fireplace

consists of a shallow, rectangular box, long enough, we suppose, to admit sticks of wood of two feet in length. This oblong box has doors at each end of it, for the admission of air, and upon it stands the oven, flues, &c., in the form of an ordinary cooking stove. In the projecting end of the lower box, or fireplace, and also in the top plate, above the oven, there are openings for kettles, &c.

2. For an improvement in the *Apparatus for Tanning*; James R. Deniston, Connersville, Fayette county, Indiana, August 1.

In the petition, it is stated that the improved apparatus "consists of a vat protected from freezing in the bark house, in which is manufactured ooze of every desirable quality, from which it is strained off into a general reservoir, from whence it is dispersed, as required, throughout the yard, or raised to an elevated vat, and then dispersed, all by means of pipes, so placed under ground as to prevent freezing. The hides are hung perpendicularly in the vats of the yard. By means of this improvement, there is a vast saving of labour and bark; at least twice the usual expedition; and excellence in tanning is secured, and no weather prevents the usual operations of the yard."

The foregoing is so perfect an epitome of the specification, that we deem it unnecessary to give any thing more. There is no claim made, and from the tenor of the description given, and the accompanying remarks, we apprehend that what is intended to be patented is the securing the tanning liquor from the influence of frost; this, however, ought to have been distinctly stated, as, in the detail, many things are described which are common in tan vats, and are not, therefore, patentable.

3. For a *Washing Machine*; Avery B. Gates, Connersville, Fayette county, Indiana, August 1.

This patentee also has given, in the petition to the Secretary of State, a short description of his machine, which, as it suits our purpose, we shall copy. Those who are learned in the history of washing machines, will see, from this description, that there is little, or nothing, upon which a legitimate claim could be founded; the patentee, himself, has not attempted to make any.

"This machine consists of a box, set on legs;—a shoe, or concave bed, is let loosely into the box; the inner part of this shoe is in the form of a semi-cylinder, filled with rolling rounds, so as to admit a cylinder filled with stationary rounds. Elasticity is given to the shoe by means of wire springs, placed in the corners of the box; the shoe is raised or lowered at pleasure, by means of rods passing through the springs, &c. &c."

4. For an improvement in the mode of constructing the roofs of buildings, and a *Composition for Covering all kinds of Roofs, Brick or Stone Walls, Boards and Timber, exposed to*

the Weather; Daniel A. Balcom, Northampton, Bucks county, Pennsylvania, August 1.

The compound, resinous cement, here patented, is composed of eight parts tar, four parts rosin, and twelve, or fourteen, parts of finely pulverized dry clay, which are to be mixed together, and boiled until all the water has evaporated. Care must be taken that the ingredients be so proportioned, heated, and incorporated, that the mixture shall not be liable to melt and run by the action of solar heat, or to crack by its contraction from cold. The cement is to be laid on with a hot trowel, and all cracks and interstices must be carefully filled up. Among the purposes to which it is proposed to apply it, the coating of ships' bottoms, instead of copper sheathing, is mentioned.

The patentee says that "the application of the cement to the before named purposes, is what is particularly claimed, the chemical union of rosin and clay having been known before."

We are very certain that such a claim is altogether nugatory; the kind of cement described, that is, one substantially the same, has been made and used almost from time immemorial; there is little or no novelty in the application of such a cement to the purposes designated, and even if there were, we do not believe, as we have frequently had occasion to say, that the mere application of a known article to a purpose analogous to that to which it has been repeatedly applied, can be accounted an invention.

5. For an *improvement in the Thrashing Machine*; John Marshall, Jr., Sweden, Monroe county, New York, August 1.

The so-called improvement is rather an appendage to the thrashing machine, as it is intended to agitate and carry away the straw, after it has been passed through the ordinary beaters. An endless apron is to be made by taking two long ropes to form its sides, or edges, and from one to the other of these ropes, slats, or wires, are to extend, parallel to, and within an inch or two of, each other. This apron is to be stretched upon, and to pass over, rollers, and upon it the straw is to be delivered as it is thrashed; it is to be of such length as to carry the straw out of the barn, and, during its passage, a beater is to strike upon it, to agitate the straw, and shake out the last portions of grain. It is to be moved by the same power which gives motion to the thrashing machine.

6. For a *Truss for the cure of Hernia*; Thomas Lawrence, Clarke county, Kentucky, August 4.

A pad is to be made of wood, which may be round, and from two to five inches in diameter. The side intended to be worn next the body, is to be convex, and the opposite side flat; this pad, or block, is to be perforated through its centre, to admit a wooden pin to slide in it, which pin has a head of such size as shall pass into, and bear upon, the ruptured cavity. In the drawing, the sliding shank is represented as of about half an inch, and the head about an inch, in

diameter. The pin is acted upon by two spiral springs upon the back of the pad, which are to press upon it, at first, with considerable force; the intention, it is presumed, is to irritate the part, so as to produce inflammation and adhesion; this, however, is not said. The pressure is to be gradually diminished as the cure proceeds. The pad is to be kept in its place by suitable straps round the body. There is no claim made.

7. For a new manufacture of *Figured Fabrics*; John Smith, Shaeffers-town, Lebanon county, Pennsylvania, August 4.
(See specification.)

8. For a *Blacksmith's Striker*; Joel Woodel, Jackson, Madison county, Tennessee, August 6.

The apparatus described and figured as the subject of this patent, is so similar to that patented by Mr. Lewis Stripe, of North Carolina, and described at p. 172, vol. xiii., that we do not see how it can stand in law, unless patents can be obtained for each of the states individually, and each of them can find a true and original inventor of the same thing.

This striker has become the subject of altercation between two previous patentees, and if the declarations made by persons claiming to be informed on the subject, are worthy of credit, the invention is much older than either of their patents, having been long known and used in North Carolina. The present patentee does not prefer any claim.

9. For a *Cast-iron Sink*; Zenos Tarbon, Franklin, Delaware county, and Levi B. Tarbon, Onconta, Otsego county, New York, August 6.

The description of this affair is so very brief, that it would seem impossible to say any thing about it in fewer words than those used by the patentees, which are: "The sink is thirty inches in length, and twenty inches in width, with a soap dish in one corner, and a hole through the bottom to let off the water; all of which is made of pot metal, and cast whole."

We do not admire long-winded specifications, but still, having some portion of curiosity, and some sense of justice, we should like to know how to mete to each of these joint inventors his due portion of the mental labour expended in inventing the discovery by them set forth. The form of this said sink has nothing new, and is not, therefore, the invention of either; nor is cast-iron, or "pot metal," a new *composition of matter*.

10. For improvements in the construction of *Bee Hives*, and the *Management of Bees*; Levi H. Parish, Brighton, Monroe county, New York, August 6.

In the construction of the hives here recommended, there is nothing very peculiar; but they are to be large, and to be divided into separate

compartments, by means of smaller boxes fitting into them, which boxes may be removed and replaced at proper periods. The main thing insisted upon is the advantage of keeping the hives within doors, in the upper rooms of a dwelling, or other suitable building. The benefits resulting from this are fully set forth, with much earnestness and good sense. The specification, in fact, would be a very good article for a journal devoted to the useful arts, but for the purpose of securing any exclusive right or privilege, it is altogether useless. The housing of bees in the manner directed is not new, nor is the dividing of a rectangular hive into compartments, by separate boxes, a thing which could be claimed at the present day; yet these two points are among the most conspicuous of those presented to us; even were they new, as they are not distinguished from other things which accompany them, and which are not so, they would not be secured to the patentee, whose business it is to distinguish his invention "from all other things before known or used," instead of which, not a syllable appears in any part of the instrument, which can lead to a knowledge of what was intended to be patented.

11. For an improvement in *Weavers' Harness*; John Blackmar, Killingly, Windham county, Connecticut, August 7.

"What I, the petitioner, claim as new, and as my own invention, is the so constructing the harness as to have a fixed tie, or knot, in the lower end of the eye, where loops have been heretofore used. In the common harness, in the operation of springing the web, the loop is liable to work, or slip, in the eye, and thus fret out either the twine of the eye, or the loop, before the rest of the harness is worn out."

The drawing which accompanies the specification, represents the common mode of forming the loop, and also the manner of tying the knot employed by the patentee. Although the practical advantage of his mode is insisted on by the inventor, it is by no means apparent to one who is not thoroughly initiated in the art and mystery of weaving. How this new kind of knot is tied, we cannot tell in words, albeit we know something of a knot which words will tie; and not thinking it necessary to employ the engraver, we must refer those who wish to know more upon this subject, to the proper office.

12. For an improvement in the art of *Manufacturing Nails*; Freeman Palmer, Buffaloe, Erie county, New York. Patent first issued October 25th, 1832; surrendered, and reissued upon an amended specification, August 7.

The present specification does not vary essentially from the former, which was noticed at p. 233, vol. xi. The claim now made, is to "the peculiar mode of making nails, as before described, with the peculiar shape of the rollers, to give a proper formation to the plates for the heads and blades of the nails; and in the form of the cutters, or knives, to give the required shape to the nails." The former claim

was altogether indefinite, and was one, the validity of which was, at the least, very doubtful.

13. For an improvement in the construction of the *Saw Mill*; Thomas Blanchard, city of New York, August 8.

A circular saw is to be used to cut the timber, which timber is to be fixed upon a carriage, constructed and moving in the manner of the common saw mill carriage. The shaft of the saw runs in gudgeons upon a sliding frame, which is so constructed as to allow of its being shifted transversely to the carriage, in order to obviate the necessity for moving the log laterally, after a cut has been made. The different movements required are to be communicated by means of bands and whirles.

"The principle of this invention consists of the combination of a circular saw with a common saw mill log carriage, of any convenient construction; the said shifting carriage being made to slide at right angles with the log carriage; the thickness of the boards, plank, or other lumber to be cut, and to be firmly fixed in its position during the action of the machine, substantially as the same is above described. Circular saws are not claimed by this applicant, nor the construction of circular saws upon shifting or sliding carriages; nor does he claim a patent for the particular construction of the said shifting carriage, nor the index whereby the extent of its lateral motion may be adjusted and fixed. But the invention which he claims consists, as aforesaid, of the combination of a circular saw on a shifting carriage, constructed substantially as aforesaid, in any convenient form, and capable, by any convenient means, of being shifted and fixed in operation with a log carriage of any convenient construction; differing from the common and known saw mill in this especially, that the saw in these is not made to shift, but the log is shifted in its carriage, according to the thickness of the lumber to be sawed."

14. For an improvement in the mode of *manufacturing Butt Hinges*; Dorwin Ellis, Attleborough, Bristol county, Massachusetts, August 8.

This patent is taken for the process by which the hinges are manufactured, there being, confessedly, nothing new in the machinery, which, in the present case, is merely adapted to the purpose to which it is applied. Strips of metal, about twelve inches long, and of a proper width, are to be cast with a projecting ridge along their whole length, which ridge forms the knuckle, or joint, of the hinge. The strips, or plates, so cast, are to be passed between rollers, having grooves in them corresponding to the ridge in the strips; by this means, they are equalized, and are then to be placed in a screw, or other press, where they are cut off, and the joints formed. The blanks, or halves, are next to be fixed in a drilling machine, of the usual construction, after which they are ready for the pins.

The patentee says, "I claim no exclusive property in the construction of these several machines, but I claim the successive application of them in effecting my said process of manufacturing butt hinges, as above mentioned. And also the particular form of the metal plates, or ingots, with which I commence my process."

Patents are granted for "any new and useful art, machine, manufacture, or composition of matter," and if the foregoing patent is valid, we think that it must be so in consequence of its standing in the first category, and, therefore, that it should be designated as "a new art, or process, employed in the manufacturing of butt hinges." We presume that it would be so considered in a court of law.

15. For an improvement in the single twist *Screw Auger*; Nathaniel C. Sanford, Meriden, New Haven county, Connecticut, August 8.

The single twist auger is that sometimes known under the name of L'Hommedieu's auger. The improvement made by the present patentee consists in adding a second cutter, or lip, similar, and opposite, to that with which the instrument is ordinarily furnished. Directions are given for forging the auger so as to form these lips in a convenient manner; and it is said that when thus formed, it unites to the good properties of the single, those of the double screw auger, and is, therefore, superior to either. The patentee claims only "the formation and addition of a second lip to the common, single twist, spiral screw auger, which has hitherto been made with one lip only."

16. For an improvement in the spiral *Screw Auger*; Alfred Newton, Meriden, New Haven county, Connecticut, August 8.

This, instead of a two, is to be a three lipped auger. The part which is to form the spiral, is to be first forged into a triangular form, and each of the sides is then to be hollowed, or fluted, by means of a suitable swage. For an inch auger, these hollows should have a depth of about three-eighths of an inch, and in the same proportion for other sizes. The cutting edge is to be so forged as to allow of the formation of three lips, and an entering screw with three threads. This auger, when twisted in the usual way, will, it is said, "be stronger, and bore more easily, than those of the ordinary construction."

The claim is to "the formation of an auger with three lips, or cutters, and a triple spiral, in contradistinction to the augers now made, which have not more than two lips, and a double spiral."

17. For a *Fire Engine*; Thomas A. Chandler, Norfolk, St. Lawrence county, New York, August 8.

The description refers throughout to "the model," but there is also a drawing, making the construction sufficiently clear.

At the end of the description, we are informed that "The machine will receive and discharge twice the quantity of water, in the same length of time, with half the manual labour of the common fire en-

gines;" which most certainly is a very great mistake. We really believe that it would be much nearer the truth to say that, with double the manual labour, it would throw half the quantity of water of the common fire engine; we are ready to confess, however, that this, though true, would be a libel, as it would be calculated to make an unfair impression; but, most certainly, the friction in this engine will be, at least, twice as great as that of ordinary engines discharging the same quantity of water. There are to be four cylinders, their centres forming a rectangle, and their pistons having rods formed into racks, which take into segment wheels, upon the shaft of the levers that work the pistons. The water, from the four barrels, is to be forced into a common receptacle, furnished with an air vessel, and with two discharge pipes, in order, if necessary, to play two streams at once.

The claim is to "the *arrangement* of the several parts, so as to produce the engine herein described."

It requires no great portion of mechanical knowledge to enable any one to decide that the rubbing surface of four pistons is much greater than that of two of equal capacity, and of the same length of stroke; that a rack and segment wheel is by no means the best arrangement for working a piston rod; and that the increased number of valves and water ways must be attended by a considerably increased resistance.

18. For an improvement in *Machinery for Dying and Printing*; James Rennie, Lodi, Bergen county, New Jersey, August 8.

The specification informs us that the invention here claimed is "an improvement and combination of machinery for dying, stamping, or printing, two or more different colours, mordents, or shades, at one impression, which improvement and combination I denominate the *magic sieve*." This is followed by a transcript of the whole of the specification of the patent obtained by the same gentleman, on the 9th of June, 1834, and noticed at p. 31; and this is succeeded by a description of the *magic sieve*, which consists of an extension and variation of the same principle, or combination, that was the subject of the former patent.

The space occupied by the horizontal plate on which the sponge, &c., was to be placed, as described in the former patent, is to be divided into two, or more, compartments, by vertical, metallic partitions; and each of these compartments is to be supplied with a separate colour, by the means there set forth. The block with which the printing is to be effected, is to be so constructed that it will span these partitions, and allow the different parts of it to dip into the respective colours. "By applying the type, form, or block, to the sponge, or sieve, within the spaces, the different colours and shades will be communicated to the appropriate parts, and may then be stamped, printed, or impressed, on the cloth, paper, or the material to be printed, at one impression."

"The above constitutes a description of the improvement and combination of which I allege and claim the invention."

19. For a *Churn*; Joshua Ricker, Bangor, Penobscot county, Maine, August 9.

We cannot, in general, find much room for churns, but when their inventors make a claim, we always give it; in the present instance, there is one in the following words:

"What I claim as my invention, is the form of the churn, with a bottom half round, so that the ladle boards will play within one-fourth of an inch of the circular bottom, and thus all the cream is moved alike. It will separate every particle of butter from the milk, leaving none. I also claim as an improvement, the manner of putting in and taking out the shaft. There has been a great difficulty in churns heretofore used, when cream is very thick, in removing the butter from the milk in the corners of the churn, which the ladle boards would not reach. In this I claim an improvement, and also in the gear, and form of the shaft, and also in making the shaft in two pieces, to prevent leakage. I also claim as my right, the privilege of increasing the number of ladle boards in the shaft to ten. I also claim as my improvement, the right of framing the body of the churn together." Many of which claims and rights no one will dispute, provided they are not exclusive, which several of them, certainly, ought not to be.

20. For a *Composition of Matter applicable to the construction of Roads, Streets, &c.*; John Martineau, Eldridge, Onondaga county, New York, August 11.

The claim at the close of the specification of this patent, will exhibit clearly the object for which it is obtained.

"What I claim as my invention and improvement, is the application of tar, turpentine, or any other of that class of cohesive substances, reduced before use to a fluid state, and in that state used as a cement to apply to, and combine with, sand, gravel, pebbles, pulverized stone, such as is used for a Macadamized road, or cobble stones; the interstices of coarse materials being in all cases filled, as well as may be, with sand and gravel, and cemented with tar, or turpentine, to form the wearing surface of roads, streets, &c., in the manner described in this specification, however the same may be modified or varied in practice. I also claim the application of the before mentioned cohesive substances, combined with sand, or other material, to the lining of canals, raceways, flumes, reservoirs, cisterns, &c. &c., in all the varied forms which practice may suggest, however modified, or varied."

We have, for many years, been in the habit of speaking of tar as one of the best articles which could be employed upon roads. Those who have noticed the wharves, or other places, where tar has been spilt on dusty roads, must have observed that it serves to cement the materials so firmly, that, after its incorporation with the dust,

or sand, is completed, the heaviest loads actually make no impression upon it.

21. For *Hulling Clover Seed*; Benjamin Wood, Doylestown, Bucks county, Pennsylvania, August 11.

The clover is fed on to a sloping sifter, by the shaking of which it is to be separated from the straw; this sifter has a tight bottom, and above this a false one, which is perforated with holes sufficiently large to admit the seed to pass through. As the seed falls from the sifter into the hopper, through a vertical opening, it passes the mouth of a flue, leading from a revolving fan, the wind from which blows the clover and light stuff into the hopper, whilst stones, buck-horn, and other heavy articles, fall through the vertical opening, and pass out of the machine. At the bottom of the hopper there is a revolving cylinder, with its concave, on the ordinary construction.

The claim is to "the sifter, as above described, and particularly the separating principle by fan, wind, and flues, whether in the exact form or not, so as it effects the same purpose."

We cannot perceive any thing new in this sifter, or in the "separating principle," as that is fully described by Oliver Evans, in his "Millwright's Guide," published forty years ago.

22. For a *Heat Retaining Cooking Stove*; John Moffat, Buffalo, Erie county, New York, August 13.

Of this stove there is a very long, but, at the same time, a very inadequate, description, in consequence of which, after conning over six closely written pages of foolscap, we know but little about the actual construction of the affair; and the drawing, although very well executed, affords but little aid, as it furnishes no more than a view of the exterior case, with its doors. On arriving at the end of the specification, we had hoped that the inventor would there point out what he considered as new in his contrivance, but here also we were totally disappointed, there not being any thing in the form of a claim. We are told, however, that it possesses many virtues, as "it is the opinion of the inventor that, from its facility of retaining, and of emitting, the heat, as occasion may require; from the small quantity of fuel required to perform a large amount of service; from its ease of management, and a variety of other favourable circumstances, it possesses great advantages over any other stove now used for the same purposes."

From what we can gather in the specification, the main object in the view of the patentee was to construct a stove, which should be surrounded by reflecting and non-conducting substances, forming an inner and outer case. For this purpose, a wooden case is made, having its interior covered with sheet tin, which, however, is to be sustained at the distance of an inch and a quarter from the wood, the space between them being compactly filled with cotton. There must, of necessity, be a space of several inches between the case and the stove, in all directions. To allow of a free play of heat within

the case, the sides of the stove are, in part, constructed of vertical bars.

"The said 'self heat retaining stove,' so constructed, in manner and form hereinbefore particularly described, will retain the heat generated by the fire, within the case, so that the heat of the said fire can be used for cooking, or other purposes, without having any heat in the room in which it is placed. And it is so constructed that the said spaces in front of the grates, in the front side of the stove, and also the back end, can be used at the same time with the space within the case on top of said stove, and with like effect, for like or different purposes."

As there is nothing claimed, every thing described is, of course, included in the patent, but, in this stove, there are many things in common with others, such as grates, flues, &c., a claim to which could not be sustained. We will at the same time observe, that in what appears to be considered by the inventor as the distinctive characteristic of this stove, he has been anticipated, Mr. J. Hurd, of Boston, having, in November, 1829, obtained several patents, in which the same principle was applied; tin reflectors, within an outer case, being employed in an oven, or other cooking apparatus.

As respects the compact lining of cotton, it would be altogether useless; the more flocculent such a lining, or stuffing, the better; and, in fact, to have air alone between the tin and the wood, if confined with moderate care, would be preferable to any other mode of construction, as it is a worse conductor of heat than cotton, or even than charcoal itself.

23. For a *Fly Driver*; R. H. Faunt Le Roy, New Harmony, Posey county, Indiana, August 13.

The *fly driver* is "intended to keep, or scare, away, flies, moschetoes, and other insects, from beds, cradles, tables, and other places where said insects are troublesome, by means of fans, wings, brushes, curtains, or feathers, kept in motion by means of a machine, without the attention of any person."

Every one who is conversant with wheel work, and indeed those who are not so, can very readily conceive that a vertical case may be made, which may stand as a pedestal and column, and have within it wheels and pinions, kept in motion by a weight of thirty pounds, thence communicating a vibratory movement to a shaft at its upper end, whereby flies, &c. &c., may be driven, or scared, away. Many contrivances for this purpose have, in fact, been made, and some of them patented; of these, we will refer to two by Commodore Barron; for a "Fan for bed-chambers, dining rooms, halls, &c., moved by mechanism," Nov. 27, 1830; and a second, for an improvement thereon, patented June 13, 1851. The resemblance between those machines and that under consideration, is such as might be anticipated; the patentee of this last has not made any claim, and, if he had, we should not think his right worth a law suit.

24. For an improvement in *Fire Proof Wrought Iron Chests*, and in locks and fixtures therefor. First patented March 7th, 1826; patent surrendered, and reissued on an amended specification, August 13.

In the original specification, the manner of making this chest was pointed out, and nothing more included, probably, than what the patentee considered as exemplifying his improvements; they were not, however, claimed in any form, nor was there any thing to indicate in what his improvements actually consisted. The specification before us is of much greater length than the former, entering into various particulars, not there touched upon. There is, first, a description and drawing of the chests, as made of wood, and covered with wrought iron, as imported from France; and secondly, a description and drawing of the chest, as manufactured by himself, in order to point out the specific differences between them. A claim is then made to "the combination and application of the above described alterations and improvements on the old French chest, or safe, namely:

"1. The making the bevil rest, and bevil ends, of the door, or doors.

"2. The cast iron half globe round heads, for rivets, bolts, screws, and nails.

"3. The hinge or hinges as described, and seen in the drawings.

"4. The method of shooting forth lock bolts in different directions, at one turn of the key, as seen in the drawings.

"5. The manner the lock is screwed on the wooden foundation of the door, as seen in the drawings.

"6. The new additions of appropriate iron bearings at the four corners of an iron chest, to secure the castors to it."

25. For a *Press Tub*, for pressing seeds, kernels, &c.; Francis Follett, Petersburg, Virginia, August 14.

The principal improvement claimed in this patent is the mode in which the strainer is made, that forms the bottom of the tub.

"The strainer is formed by making an iron hoop, say seventeen inches in diameter, half an inch thick, and three-fourths of an inch deep, more or less. This is to be turned true, and to fit exactly into the rebate in the cylinder. To form this into a strainer, I take hoop iron, of the same width as the aforementioned hoop, and of such thickness as I may prefer, say one-sixteenth of an inch, and this I coil round in the manner of the spring of a timepiece, leaving a small space, say one-sixteenth of an inch, between each coil, and continuing it until it fills the hoop entirely. This I confine in its place by passing rods of round iron through it, and through the hoop, or in any other suitable manner." "What I claim as my invention, is the forming of the strainer in the way described, and the manner of adapting it to the cylinders, for the purpose of pressing seeds, and other articles."

Some variations in the mode of forming the strainer are pointed out, which we do not deem it necessary to particularize.

26. For a *Cooking and Heating Stove*; Samuel B. Sexton, Philadelphia, August 14.

The oven, and many other parts of this stove, do not differ in any essential points from such as are ordinarily constructed. The patentee considers his improvement as depending, principally, on the mode he has adopted of generating and conveying heat; he says, "For the purpose of generating and conveying heat, for the heating of apartments, I pass any convenient number of tubes of metal through the stove, from front to back, the plates being perforated to receive them; these tubes may be two or three inches in diameter, and, in general, they stand in a row parallel to each other, immediately over the fire, and under the oven. The open mouths of these tubes, in front, are covered over with a casing, which I call a conductor, as the air which is to be heated in the tubes, is conducted into them through it; tubes are to lead into each end, or other part of the conductor, from a cellar, or other apartment, or out of doors, to supply it with air. Over the open ends of the tubes at the back end, I place a cover, or drum, sufficiently large to embrace the whole of them, and to become a hot air chamber, into which it is to pass from them, for the purpose of being conducted into such room, or rooms, where it may be required."

"In summer, when the heating part of this apparatus is not wanted, the tubes which pass through the stoves may be removed, and the openings covered by plates, or stoppers."

"What I claim as my invention, is the manner in which the heating and cooking apparatus are arranged, and combined together, for accomplishing the object herein described. I do not claim any of the individual parts which I have mentioned, they all having been previously used, either separately, or combined in other ways; but not, as I believe, in the manner in which I have combined and arranged them."

27. For an improvement in forming *Bodies for Hats*; William Nunns, city of New York, August 14.

Hair cloth, formed of horse, or other, hair, suitable for the purpose, and combined, if desired, with other filamentous substances, is to be formed into a body, and stiffened by any of the ordinary methods. The body so formed is intended, principally, as a foundation for silk hats, but it may be used with other material, or by itself, which use the patentee would consider as a part of the present invention.

28. For a *Horse Power*; John A. Pitts, and Hiram A. Pitts, the former of Brinthrop, Kennebeck county, the latter of Livermore, Oxford county, Maine, August 15.

The improvement in the horse power claimed by the patentees, they denominate an "Endless chain and cog band."

In the specification of this patent, various modes are proposed of forming the endless bands, or chains, to sustain the wooden slats upon which the horses are to walk. There are also several modes suggested for taking off the friction of the movable floor, and also for preventing its swagging. In the first case, the patentees say, "We make two chains, similar to the flat chains used in common carding machines, only larger. The square or open link may be made of round rod iron, of any convenient size, according to the strength needed. Upon the flat links we fasten, by bolts or otherwise, logs, or slats of wood, of such thickness, length, and breadth, as will make the band of the required size. The two ends of this band being connected, the band then passes over two cog wheels, or drums, and thus the machine is ready to receive the horse."

As we have already remarked, two or three other modes of forming the chain are proposed; but some of them are, like the preceding, perfectly similar to such as have been previously adopted.

One of the methods of sustaining the revolving floor, and preventing its friction, is the forming an endless band of friction rollers, which run upon, and under, ways, in a manner that has been proposed and practised in other structures. All the different methods described, are distinctly and separately claimed.

29. For a machine for *Doubling, Twisting, and Laying, Spun Tobacco*; James Maurey, Petersburg, Virginia, August 15.

This machine resembles, in its general construction, some of those used for doubling and twisting cordage, but so altered as to adapt it to perform the same operation upon tobacco, and thus to facilitate, in an important degree, the manufacture of twist.

The claim is to the construction, combination, and adaptation, of this machinery to the manufacturing of tobacco.

30. For an improved *Oven*; Richard R. Tonge, Fryeburg, Oxford county, Maine, August 15.

An oven made of sheet iron, and set into a chimney jamb, in the manner well known, and long practised both in England, and with us, is shown in the drawing, and alluded to, but by no means described, in the specification; very properly, however, there is no claim made.

31. For a machine for *Hatchelling Hemp, Flax, and Wool*; Daniel Treadwell, Boston, Massachusetts, August 18.

The specification of this patent refers throughout to the drawings, and we do not think that without them the construction of the machine could be understood; we shall not, therefore, attempt to describe it. The claim made is to the combination of the respective parts, as constituting the hatchelling machine."

32. For machinery for *Tarring Rope-yarns*; Daniel Treadwell, Boston, Massachusetts, August 18.

The patentee states that his improvement consists in three distinct parts. First, in the method of heating the tar; second, in rubbing, or untwisting, the yarn, for the purpose of saturating it with tar; and third, in the nippers for pressing out the superabundant tar.

As in the last patent, the aid of the drawings would also be requisite to a clear understanding of the operation of this tarring apparatus. The white yarns are wound upon bobbins, fixed in a proper frame, and the kettle in which the tarring is effected is a long trough, above which there are sliding bars, having perforated metallic plates at their lower ends; through these the yarns are passed, and by their means can be lowered into, or withdrawn from, the tarring kettle. The untwisting of the yarn is effected by a very ingenious contrivance, consisting of additional perforated plates, which have a motion communicated to them by means of cranks, in such a way that the yarn passes through the first named fixed plates, with the twist so far removed as to allow the tar to penetrate readily through the mass.

The claims made, are to the improvement in tarring by heating the tar by steam, as described; to the rubbing, and at the same time untwisting, the yarns, as they pass from the bobbins through the tar, so that it may penetrate between all the fibres of which they are made up; and to the manner of constructing the roller nippers, by which the superfluous tar is forced out from the yarns.

33. For an improvement in the art of *Extracting the precious metals from their Ores*; John L. Sullivan, city of New York, August 18.

It is our intention to give a full description of the apparatus which forms the subject of this patent; but knowing that the patentee intends to introduce further improvements in the mode of procedure pointed out by him in his specification, we will, at present, merely observe, that by the machinery employed, the ores of gold, and more especially auriferous iron pyrites, are to be exposed, when pulverized, to the united influence of heat and motion; the heat being principally supplied by a current of air, which will carry off the sulphur, and other volatile matters, and thus leave the gold in a proper state to be separated from the ore by amalgamation, either in the same, or in an auxiliary instrument.

34. For a *Thrashing Machine*; Isaac Gallop, Plainfield, Windham county, Connecticut, August 18.

This machine is nominally new, but substantially old. It is called the "New Thrasher," but consists of a cylinder set with teeth, and a concave similarly furnished, so much like others previously in use, that they might very well be confounded together. The patentee, however, seems to think otherwise, for he claims as new and useful, and of his own invention, the peculiar structure and position of the *concave base*, and its relative proportion to the cylinder; the arrange-

ment of the teeth on the same, and their peculiar contact with those on the cylinder. The position and effect of the bevil cogs, and the relative size and proportion of the several wheels, pulleys, cog wheels, to and with the motion wheels, and the cylinder, together with their combinations, are all new and useful in their results, and are a discovery of his own, and belong to no one else, and for these improvements and discoveries, this patent is claimed, and is to be known and designated by the name aforesaid, viz: "THE NEW THRASHER."

Should it be thought proper to add a winnowing, to this thrashing machine, we advise that great care be taken not to pass this claim through it, lest it disappear altogether.

35. For an improvement in *Fire Ladders*; James Lee Hannah, M. D., city of New York, August 19.

A ladder is to be made in the usual way, but having the two sides parallel to each other. The topmost round is to be a bar of iron, which is to project through the cheeks of the ladder, and is to have a round roller, or wheel, at each end, which, by their rolling upon the wall are to facilitate the raising of it. The main ladder may be forty feet in length; but there are to be additional sections, each of from five to eight feet long, to be fastened on its bottom, when necessary; strong bolts at one end of these sectional pieces are to pass through staples at the lower end of the ladder.

A box called a safety box, is to be adapted to the ladder, having proper guides to cause it to slide securely upon its uprights, or cheeks; in order to elevate this safety box, there are to be two pulley blocks, one on each side of the ladder, attached to the iron bar which forms the upper round; ropes passing over the sheaves of these blocks, are hooked to the safety box, and men drawing at the other end, raise it to the top of the ladder.

The claims are to the rollers, the sliding safety box, and the sections to be added to the main ladder.

Numerous contrivances have been made to facilitate the escape of persons, and the removal of goods, from houses on fire, but they have never come into general use, and it is probable that they never will. Even the common fire ladders, provided by corporations, are usually suffered to pass into decay, in consequence, undoubtedly, of their being but very rarely employed, or wanted. As this is the case, they are never carried to fires until circumstances render it necessary, when they are apt to arrive too late to be useful. To be available in large cities, such machines must be very numerous; for those who are active at fires, expect to be most useful by immediate attendance; and those who are not so, will not run after, and carry, heavy ladders and their appendages; we do not believe, therefore, that the present patentee will meet with much encouragement in his undertaking.

In the eighth volume of Borgni's "*Traité complet de Mécanique*," plate 12, a fire ladder may be seen, furnished with rollers at its upper end, for the purpose designated in the present specification; we

could also point out drawings of buckets, or boxes, to be elevated by means of tackle, in the way described; and, indeed, we see nothing new in the present contrivance, excepting the parallelism of the two sides of the ladder, for the more convenient sliding of the safety box; and the particular manner of lengthening the ladder, as described.

36. For an improvement in instruments for *Cutting and Crumbling the Stone in the Bladder*; James Lee Hannah, M. D., city of New York, August 19.

These instruments for cutting and for crushing the stone, are, when closed, in the form of a sound, or catheter, but considerably curved at the end which is to enter the bladder. According to the drawing, the shaft is straight, but the end is bent round so as to form a quarter of a circle of about three-fourths of an inch radius. This quadrant constitutes the jaws by which the cutting and crushing are to be effected; these jaws work on a pin near the extreme end, and when closed, form a round smooth body, having no projection to obstruct it in its entrance; its opening commences at the point where the curve terminates and joins the straight shaft. This straight shaft consists, exteriorly, of a thin silver tube; and through this tube passes a steel spring, like a watch spring, which, when pushed in, allows the jaws to open, the spring being attached to the jointed piece. The cutting instrument has edges like shears, the crusher opens like forceps, and has teeth to hold and crush the particles of stone which have been divided by the cutter.

There is an apparatus described, which is to be attached to the shaft when it has been inserted, for the purpose of closing the jaws of the cutter, or crusher, by a graduated and measured force. By the turning of a nut, a screw is made to draw upon the spring which closes the jaws, and between this screw and the spring, there is inserted a, spiral spring, weighing instrument, upon the slide of which the screw acts, and it is thus made to indicate the force applied, in pounds, or parts of pounds.

This description will give to the surgeon a general idea of the construction of the instrument. Whether it is really an improvement upon that of Civiale, experience must decide. The objections which immediately present themselves, in our view of it, are the abrupt curvature of its end, which may interfere with the facility of its insertion; and the use of the spring, jointed on to the jaw. The objection made to the instrument contrived and patented by Mr. Luken, of Philadelphia, we have understood, was the use of his jointed springs for holding the stone, which might possibly break whilst in use—an accident of fearful import.

The things claimed are, "1st. The curve of the instrument being in two sections, one moving as a joint, or a screw or rivet, which serves as a fulcrum to the sections. 2d. The sections being formed with edges to cut, or with teeth to crumble, the stone. 3d. The groove in the shaft or handle of the crumbler. 4th. The application of the elastic

steel spring, by which the instruments are opened and closed. 5th. The application of the silver or other metallic tube, to keep that spring acting properly in its place. 6th. The application of the wooden trough, screw, and nut, as means of exerting power. 7th. The application of the rider to keep the hook of the wooden screw acting properly in its place."

We think that these claims enter too much into the particular formation of the individual parts of the apparatus, and that it would have been better to have claimed the instrument substantially as described, whether the particular parts are made precisely in the manner given, or varied in form only, whilst the principle of action is preserved.

37. For a *Machine for Grinding Grain*; Joseph Grant, Providence, county of Providence, Rhode Island, August 19.

This is to be a cast iron mill, consisting of three cylinders and a concave, all of which are to be so fluted as to form teeth not more than a quarter of an inch wide, and an eighth of an inch deep. Two of the cylinders, with a hopper above them, are to be placed horizontally, and parallel to each other. The lower cylinder has a concave under it, which is adjustable by means of a screw. The cylinders are all to move with different velocities, the last with the greatest speed.

"The improvement, or discovery, consists in the combination, and in the variation of the speed of the several cylinders."

We should be more inclined to call this a machine for the breaking, than for the grinding, of grain; at all events, it will not make very fine meal.

38. For a *Thrashing Machine*; Charles Wilson, city of New York August 19.

This machine is to have a frame made entirely of cast iron, and the concave is to be formed of triangular cast iron bars, about five-eighths of an inch thick, and an inch apart, allowing space for the grain to fall through between them. The whole surface of the cylinder is also to be of cast iron, consisting of bands, or hoops, four or five inches wide, and a quarter of an inch thick, with projecting pieces, for beaters, cast on them. These bands are to be driven on to a wooden cylinder.

The claim is to "the frame being entirely of cast iron, and its peculiar construction for strength and cheapness; and of the cylinder in introducing malleable cast iron with beaters solid to the bands, with the concave bars cast solid to six supporters, and substituting the same for movable bars and bands."

39. For an improvement in the *Percussion Cannon Lock*; Enoch Hidden, city of New York, August 20.

The greatest difficulty which has been encountered in the construction of percussion cannon locks, has been the powerful reaction from the vent, by which the hammer has frequently been blown off,

and other injurious effects produced. Springs have been devised to throw the hammer out of the way so instantaneously that the reaction should not effect it, but the success in this point has been but partial. The main object of the present patent is the same, as will be seen by the following claim:—

“What I claim as my invention, and for which I ask a patent, is the manner in which I employ the reacting spring, as described under the various modifications thereof, as herein shown, by which the hammer is instantaneously thrown up, after striking the percussion cap directly upon the vent of the cannon. I also claim the manner of applying the corking lever under an arrangement by which it is made to be close to the case, or box, of the lock. Also, the spring catch, and the manner of working the trigger. And particularly the arrangement of the parts described in the second modification, by which the operation and effect therein mentioned, is produced.”

The whole arrangement, with its several modifications, are well represented in the drawings.

40. For a *Filtering Machine*; Isaac Wiseman, city of New York. An alien, who has resided two years in the United States; August 20.

The principal difference between this and the filtering vessels ordinarily employed, consists, first, in there being a separate vessel to receive the water which has been filtered, and which vessel can, therefore, be removed for the purpose of clearing it of the sediment which always finds its way into such reservoirs; and, secondly, in interposing between the layers of broken quartz, sand, charcoal, &c. perforated plates of earthenware, metal, or other substances, which will prevent their mixing with each other from agitation in removal from place to place. Such perforated plates are not new.

41. For a *Revolving Turning Steel*; Benjamin E. Hoyt, Ipswich, Essex county, Massachusetts, August 20.

This steel is for turning the edges of carriers', or other knives, by passing a roller, instead of a burnisher, over them. This roller is a cylinder of hardened cast steel, which is represented in the drawing as about two and a half inches long, and three-fourths of an inch in diameter; this is bored through its axis, and revolves on a steel shaft, furnished with a handle at each end.

The patentee says, that the advantage of this instrument consists in its presenting a revolving instead of a fixed surface, to the edge it is intended to turn, by which means it is rolled, instead of rubbed; the operation of rolling leaving the edge perfectly smooth, whilst the rubbing is apt to leave it rough and broken.

42. For an improvement in the manufacture of *Percussion Powder*; Samuel Guthrie, Sacket's Harbour, Jefferson county, New York, August 21.

(See specification.)

43. For a machine for *Separating Gold from the Soil*; John Dobson, Burke county, North Carolina, August 21.

This machine has an inclined rocker, similar to that used in many others, and various appendages which have no claim to novelty. After describing these, the patentee says: "although I have been particular in describing the construction of the above machine, yet I rest my claim only on those principles of the bucket, or receiver, by which a peculiar rolling motion is given to the mercury, most applicable to the collecting of the gold; which principles and advantages it may be necessary to mention as understood by me. In the first place, a larger quantity of mercury can be used than by the present mode, without danger of loss; and extending from side to side of the bucket, presenting a rolling edge to the approach of the gold, of sixteen inches in length. The column of water descending through the tube impinges on the sheet iron curve, at an angle of about forty-five degrees; the gold, being of greater specific gravity, slides intimately along the curve of the bottom of the bucket, until it meets the lower edge of the mercury, which, by the force of the water pressing upon it, is removed up the inclination of the opposite side, where, by a less force being exerted on the top than on the bottom, it is caused to roll over on the gold, thereby securing it by amalgamation; while at the same time, the force of the water expels nearly all the sand, gravel, &c. from or through the mouth of the bucket. The mercury being put only in the bucket, renders the inside ripple of the old machine unnecessary; the body being lighter, a brisker motion is attainable with the same force; a greater attrition is thereby given to the grit; and as a large quantity of water can be used, a separation between the mass and the gold is obtained with much greater facility than with the usual quantity."

44. For a *Clover and Herdgrass Hulling Machine*; Reuben Ranger, Wilton, Kennebeck county, Maine, August 21.

This instrument need not detain us long, as there is little or no novelty about it, and no part of it claimed by the patentee.

The hulling is to be effected by rubbing the seeds between perforated plates of sheet iron, one portion of which is a conical body, and is made to revolve upon a shaft placed horizontally; this is surrounded by a concave similar in form, and surmounted by a hopper. The rubbed seeds pass out through an opening in one end of the machine, at the lower edge of the base of the cone.

45. For an improvement in *Finishing Leghorn, Straw, Grass, and Palm Leaf Hats and Bonnets*; Joseph Snyder, city of Philadelphia, August 22.

The hats and bonnets are to be varnished with any of the known suitable varnishes, adapted to the colour of the article.

"The object intended to be attained by the foregoing improvement is to preserve hats and bonnets from moisture, that they may retain their proper shape."

"The part believed to be new, and claimed as an invention or discovery, is not the preparation of any particular kind of varnish, but the application of varnish now known, to a purpose for which it has not heretofore been used; that is, to the purpose aforesaid of varnishing hats and bonnets of the description above mentioned; or to the purpose of varnishing the materials from which such hats and bonnets are made."

We do not know that the varnishing of such hats as are above mentioned, has been before adopted as a process in the manufacture; we, however, have known of straw hats being varnished with black sealing wax varnish, and of the insides of the crowns of such hats being rendered water proof, in the same way, and have worn one so prepared. Palm leaf hats, also, have often been painted for the use of sailors and others.

46. For an improvement in the *Spinning of Rope and other Yarn*; Sidney D. Whitlock, Brooklyn, King's county, New York, August 22.

It is observed in the petition, that this patent is claimed for a "new application of the machine for which letters patent of the United States were granted to a certain Robert Graves, of Boston, on the first day of April, 1819."

In the specification, it is stated that the original machine is modified by the use of a double railway for the machine, or machines, to run upon; using at each end of the double track, a detached section of the track, made to revolve like the turnabouts upon rail-roads, so as to accommodate the equalizing machine. "Each track is furnished with an endless band and rope, operating as described in the specification of the said Graves' machine, herein referred to, alternately on the equalizing machines as they change tracks." The patentee states that he also, sometimes, places at each end of the tracks, the preparatory part of one of Westerman's patent hackling machines; he then adds, "What I claim as new, and for which I ask letters patent, is the application of the machine for making cordage, patented to the said Graves as aforesaid, to the spinning of rope and other yarn. I also claim the use of the double track as applied to said machine, or machines, and herein specified and described. Also the use in connexion therewith, of the preparatory part of Westerman's machine for hackling hemp, as above specified and referred to. Moreover I claim the right of varying the said machine, or machinery, as applied for the purpose, in any manner that I think proper, provided the principles remain unchanged."

If the patentee supposes that he can take from the public a machine to which they have a right, he is, most assuredly, mistaken. A machine for spinning cordage, is a machine for spinning rope, and were it not so, the machine, to whatever purpose applied, belongs either to the inventor or to the public, and we are apprehensive that the present patentee would have thought it unsafe to have used Graves'

machine during the term of the patent, without a license for so doing; the right of the public, however, is not less sacred than the right of an individual. For his own modification of the rail-way, he might have obtained a good patent, under the name of an improvement; as claimed, however, we think his right a nullity.

47. For an improvement in *Shearing Machines for Shearing Woolen Cloth*; Reuben Daniels, Woodstock. Windham county, Vermont. First patented May 13th, 1834. Patent surrendered and reissued on an amended specification, August 22.

We noticed this patent, as first issued, at p. 394 of the last volume, to which we refer. After describing the whole machine in the new specification, the patentee says, "Although I have described the machinery and apparatus of the whole of a shearing machine, yet it is to be understood that what I claim, and all which I claim as new, and of my invention and improvement, is the construction of the rotary cutter with beads, wheels, or spiders, and a metallic sheet, or sheets, as aforesaid, or of cast metal as aforesaid, with the blades soldered thereto as aforesaid, and the use of rotary cutters so constructed, and made in machines, for the purpose of shearing woolen and other cloth, either from end to end, or from list to list; and the construction and use of the sliding rest aforesaid lapping over in the machine for shearing cloth from end to end, for the purpose of saving the listing, or selvages."

48. For improvements in the *Power Printing Press*; Otis Tufts, Boston, Massachusetts, August 22.

We are informed in this specification, that "the principal difference between this power press and others now in use, consists in supplying it with paper to be printed from one side of the frame, by using two friskets, one of which is under the operation of an impression from the platten, while the sheet of paper last printed is being removed from the second frisket, and another sheet is applied. As soon as the frisket first mentioned has received an imprint from the types, it is withdrawn by the operation of the machinery from between the platten and form, and the second frisket caused to pass in between the platten and frame, there to be acted on in its turn. So in succession each passes out from between the platten and frame with its printed sheet, while the other with the sheet to be printed, is made to pass in between the platten and frame."

After this introductory account of the general principle upon which the press operates, its whole construction is fully described, the description being made perfectly clear by the aid of drawings, of which there are five, representing the machine in plan, in elevation, and in section, in a manner so complete, that a competent workman could at once construct such a press as perfectly as though he had the original by him. These drawings were executed by Mr. R. H. Eddy, Civil Engineer, Boston. We mention this fact, as it may serve to

direct patentees who wish to have this part of their application perfectly well executed.

The claims are very distinctly made, but to understand them fully, would require the aid of the drawings, and should this press sustain the character which we are inclined to give to it, not from the description merely, but from having seen it, although but for a short period, in actual operation, we hope hereafter to have the means of making its construction fully known.

49. For a *Double Cylinder Truck, for raising stone, timber, &c.*; Simon Frieze, Waterloo, Anne Arundel county, Maryland, August 23.

This truck is to run up an inclined plane, or railway, formed of parallel timbers, rising at any angle not exceeding thirty degrees. Instead of four wheels, there are to be two rollers turning on gudgeons, one at each end of the truck. An offset is to be turned down at each end of the rollers, to form a shoulder, or flanch, to keep them in their places on the ways. The part turned down is to be champhered, to cause the truck to keep the track the more readily. At the upper end of the inclined plane, there is to be a block, with a rope passing over its sheave, one end of which rope is attached to the truck, and the other drawn by horses, or other animals, to raise the load.

“The patent claimed is for the offsets of the cylinders, by means of which the truck is kept in its proper position on the track, or frame, so that burthens can be raised with greater expedition, less danger, and less power employed.”

The parts of the cylinders which are to operate as wheels, do not differ in any respect from the wheels of rail-road cars, having flanches, and cones, or what is above called a champher, operating upon precisely the same principle. The cylindrical part is, in effect, nothing else than an enlarged axle, and has nothing whatever to do with the action of the thing, as described.

50. For a machine for *Hulling Clover, and other small Seeds*; Merit Baily, Attleborough, Bucks county, Pennsylvania, August 23.

This machine consists of a combination of cylinders, a concave for rubbing, riddles, a fan for cleaning, &c. &c., all of which are well known as parts of other machines. After describing the whole, a claim is made to “the application of the riddle, or sieve, at either one end or the other of the double case, for the separation of the buck-horn, &c. Also, the small roller being coated with cement alone, without teeth, &c. And for the application of the friction rollers to the main cylinder axis.”

The things claimed are, in part, at least, of more than doubtful originality; the cement upon the small cylinder, for example, is to be of sand and glue, a coating similar to which has been repeatedly used; but the idea of claiming the running of the gudgeons of the

larger cylinders upon friction rollers, is one of which few persons would have dreamed; as, unless the patentee has lived through a century, such rollers were public property before he was born.

51. For a *Horse Power*; Joseph B. Streeter, Middlesex, Yates county, New York, August 26.

In this horse power, the animal is to walk in a circle, in the usual way, but the horizontal shaft, which he is to draw round, revolves on its axis, the inner end of it turning in a revolving cap, placed on a post fixed in the centre of the circle; near this end, the shaft carries a face, or crown wheel, which meshes into a wheel on a vertical shaft, the lower end of this shaft being sustained by, and turning upon, the upper end of the post before mentioned. The outer end of the horizontal shaft carries a cog wheel, which rolls upon a circular platform, or rim, laid upon the ground, and has mortices in it to receive the cogs of the last named wheel; these mortices insure the revolution of the wheel, and consequently that of the shaft to which it is affixed. On the top of the vertical shaft in the centre, there is a cog, or band, wheel, for the purpose of communicating the motion obtained to any machinery.

This is manifestly much more complex than the old-fashioned horse mill, and the patentee does not point out those particulars in which he deems it superior to it, and upon which its claim to utility is dependent; nor does he say one word with respect to those parts which he considers to be original, concluding, probably, that such is the case with the whole arrangement; by turning, however, to p. 311, vol. xi., it will be found that this horse power has been anticipated, in all its essential features, by Mr. R. S. Schevenell, of South Carolina, who obtained a patent therefor, on the 13th of November, 1832.

52. For *Jointing and Manufacturing Staves for Barrels, &c.*; Cyrus M'Gregory, Newport, Sullivan county, New Hampshire, August 26.

The machinery described is so imperfectly represented in the drawing which accompanies the specification, as to render it extremely difficult to obtain a clear idea of its construction, the main dependence, in this respect, being manifestly placed upon the model deposited in the patent office. All that we can say, is, that the jointing is to be effected by a wheel revolving vertically, and having a number of irons on its face, near to its periphery. The stave is to be held in a gauge, and sustained upon a suitable rest. The patentee says that "The principle upon which this improvement is constructed is, that when the stave is bent on the upper surface, or edge, of the gauge, the bilge part of the stave is much further from the centre of the circle, of which the semidiameter of the cask forms a segment, than the ends, as the bilge is deeper than the ends of the cask; as also the outside of the stave is further from the axis of the cask, represented by the lower edge of the gauge, than the inside part of the stave. This gauge, thus applied, gives both the true bilge and bevil to the staves,

when jointed. This improvement, then, consists in the construction and application of said gauge for holding and gauging the staves to the revolving jointer, which wheel, or revolving jointer, is not my invention, but has never before been applied to the jointing of staves for casks."

53. For an improvement in the surgical instrument called a *Scarificator*; George Tiemann, city of New York, August 26.

The *improvement* in the construction of the *Scarificator*, which forms the subject of this patent, appears to us to deserve the appellation, as we think that both in construction and in operation, it will be found superior to those made either in the English or the German manner. The patentee, after describing the usual mode of forming this instrument, informs us that the principal improvements made by him are, the use of pointed lancets, instead of those with rounded ends; a contrivance for using them with more exactness, and so as to cause less pain, and produce a more profuse bleeding than heretofore, whilst the mechanism is more compact, and more easily kept clean, and in order, than in the old instrument.

The lancets, instead of standing in rows upon an axis, or shaft, are all fixed upon a flat plate, which fits into a box, similar to those now in use, but smaller. For the purpose of moving the plates containing the lancets, an axis and jointed levers are placed under it, which are operated upon by suitable springs, and other appendages, that are fully described, and perfectly represented in the drawing. There is no distinct claim made, but the difference between this and other instruments for the same purpose, is clearly designated, so as to leave no doubt whatever respecting the points upon which the dependence for originality is placed.

54. For *Stoves for Burning Coal*; Abial Smith, North Providence, Providence county, Rhode Island, August 27.

What is viewed as the peculiar characteristic of this stove, is, there being two openings in front for admitting the draft of air to the fire, one of them above, and the other below, the surface of the fuel. An oven is placed behind the fireplace, with a flue passing above and below it, either of which may be closed by a damper. By this construction, the draft may be admitted above the fire, to pass downwards through it, and under the oven, or it may be admitted below, in the ordinary way, and directed over the oven.

"What I claim as my invention, is the construction by which the draft is applied to the top or upper part of the coal, and conducted downward through the coal, under the oven. The objects attained are, first, when the draft is introduced at top, the ashes fall away from, instead of towards, it, and do not clog the draft; and secondly, by the alternate use of upper and lower drafts, the greatest degree of heat is applied at pleasure to the parts where it may be wanted, for culinary or other purposes."

55. For a *Thrashing Machine*; John Matthias, Manchester, Baltimore county, Maryland, August 27.

The general construction of this machine is the same with the greater number of those in use, operating by a cylinder and concave; the point claimed as an improvement, is the mode of forming the teeth. Those upon the cylinder are to be of wrought iron, about two inches in length, half an inch in thickness, and two inches wide at the base, diminishing to about half an inch at the top; the width allows of a shoulder at the lower end, upon which a sharp tine, or shank, is formed, to be driven into the wood. Six rows of these are to be set at about one inch and a quarter from each other. There are to be similar teeth upon the concave, but the operating edges of these, instead of rising in a straight line, like those on the cylinder, are to be hollowed, or curved, so as to form them into hooks; and this is stated to afford the principal advantage offered by this machine, as these hooks tend to draw the straw in towards the teeth, and consequently operate upon it to greater effect. The only thing claimed is the "using these hooked, or curved, teeth, as above described."

56. For a *Bedstead for the Sick*; William Woolley, city of New York, August 30.

This bedstead is represented in the drawings under four different modifications, the particular arrangement of certain parts of each being claimed. The objects proposed are the same as those which have, in numerous instances, been attained in other bedsteads for invalids, and we do not see any thing in the present apparatus superior to those which have preceded it; the patentee has a right to his own modes of accomplishing his purpose, and to these his claims refer.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a Patent for a New Manufacture of Figured Fabrics.

Granted to JOHN SMITH, *Shaefers-town, Lebanon county, Pennsylvania, August 4th, 1834.*

To all whom it may concern, be it known, that I, John Smith, of Shaefers-town, Lebanon county, in the State of Pennsylvania, have invented a new manufacture of woven figured stuffs, such as carpeting, coverlids, table covers, and various other articles, either in single or mixed colours; and I do hereby declare that my said invention consists principally in the manner of preparing the chain, to form the ground, or basis, of such articles, and that the following is a full and exact description thereof.

I make the chain of the various articles which I manufacture, by taking two double, and one single thread, alternately, and in weaving the figures, the filling never floats over more than five threads; that is to say, over four double and one single thread, instead of over nine threads, as in the ordinary mode of weaving. The filling is

also in part of single, and in part of double thread, the single thread being employed to bind, or interweave with the double thread of the chain; and the double thread of the filling, which is usually of woollen yarn, is bound by the single thread of the chain. By forming my patterns in this way, no part of the fabric is loose from, but is interlocked with, the pattern on the opposite side of the cloth, and a degree of firmness, and distinctness of pattern, is given, which cannot be attained by the use of a chain composed entirely either of double or of single threads, whilst, at the same time, each thread of the filling interweaving with one of the chain, at shorter intervals than in the ordinary mode of weaving, the article is rendered more durable, and the double thread of the filling being bound down by the single thread of the chain, the pattern formed by the double filling is left as distinct in its form and colours, as in the more loose fabrics, in which the filling floats, or passes, over a greater number of threads.

All the variety of patterns given to goods of this description, may be produced in my mode of weaving, and although I have made some improvements in the loom which I use for the purpose, similar articles may be woven in the ordinary figure loom; I do not, therefore, describe, or claim, any particular machinery for effecting the object in view, but claim only the arrangement of the double and single threads in the chain, and in the filling, applied in the manner, and for the purpose, herein described. Although I have spoken of double and single threads, both in the chain and filling, it is to be understood that these denominations respect the size of the threads employed, rather than the mere fact of their being double, or single, as a double yarn may be employed in lieu of that which I denominate single, provided its fineness was such as to produce the intended effect, and a fine double yarn thus used, I should consider as interfering with my invention, as it would enable the weaver to produce a manufactured article essentially similar to that described.

JOHN SMITH.

Specification of a Patent for an improvement in the manufacture of Percussion Powder. Granted to SAMUEL GUTHRIE, of Sacket's Harbour, Jefferson county, New York, August 21st, 1834.

To all to whom these presents shall come, be it known, that I, Samuel Guthrie, of Sacket's Harbour, in the county of Jefferson, and State of New York, have invented an improvement in the manufacturing of percussion powder, for the discharging of firearms; and I do hereby declare that the following is a full and exact description thereof.

I prepare the percussion powder from any of the materials employed for that purpose, using fulminating mercury, detonating silver, and oxide of tin, or regulus of antimony; chlorate of potash with charcoal, sulphur, sulphuret of antimony, or any mixture of substances capable of inflaming gunpowder, by percussion, forming the

same into a paste, and granulating by processes which are well known; sometimes making the grains of a small size, like those of ordinary gunpowder; at other times, I make them of such size that a single grain suffices for a priming, and is substituted for the copper caps used in fowling pieces, muskets, &c.; or still larger, so that they may be used for the discharge of ordnance of all descriptions. These grains are so compounded, that they are hard enough to be packed up, and carried about, without being liable to be crushed by their abrasion against each other, or by any force to which they are ordinarily subjected. These grains are rendered water-proof by coating them with shellac, dissolved in alcohol, or any other resinous varnish. Such powder I have, for some time, been in the habit of manufacturing and vending; but I have recently made an improvement therein, which is as follows. Before the varnish with which the grains are coated is perfectly dry, I cover, or coat, them with some metallic substance; and this I do by taking leaf metal, or any of the metallic powders known under the name of bronze, or bi-sulphuret of tin, or any other metal, or metalline compound; and in these I roll the grains whilst yet tackey with the varnish. The powder thus prepared is not only improved in appearance, but has greater smoothness and durability than before. After thus coating the grains, I sometimes apply another covering of copal, or other water-proof varnish, being governed in this particular by the nature of the powder, and the purpose to which it is to be applied.

What I claim as my invention, and wish to have secured to me by letters patent, is the giving to the granulated powder a metallic covering, in the manner, and for the purpose, herein set forth.

SAMUEL GUTHRIE.

TRANSLATIONS FROM FOREIGN JOURNALS.

REPORT

To the Board of Directors of Bridges, Public Roads, and Mines, upon the Use of Heated Air in the Iron Works of Scotland and England. By M. DUFRENOY, Engineer of Mines. Paris, 1834.

(Translated for this Journal, by S. V. Merrick.)

Continued from p. 125.

WORKS IN THE ENVIRONS OF GLASGOW.

The vicinity of Glasgow is one vast coal region, the first in Great Britain, both in the extent and the thickness of the veins. This coal basin is also very remarkable for the abundance of its iron ore, both imbedded in the argillaceous schist of the region, and in regular veins, often of considerable extent.

The layers of coal in the vicinity of Glasgow, which belong to the lower strata of the coal formation, alternate with beds of mountain limestone, so that in the same locality, are often united the coal, the

ore, and flux, and often the fire clay used in the construction of the furnaces.

These invaluable advantages are in part compensated by the enormous loss incident to the carbonization of the coal in this locality, as well as by the lightness of the coke produced. From these circumstances, a ton of iron requires at the Glasgow Works for its production, a much larger quantity of fuel than in any district of England.

The employment of the heated air has produced a revolution in the Scotch works, and enabled them to sustain a competition with those of Wales.

Clyde Iron Works were, as before stated, the first in which the heated air was tried. The apparatus now in use (plate 2, figures 1 and 2,) is composed of a double row of horizontal pipes, *a, a, a, a*, 150 feet long. These pipes are nineteen inches in diameter, and one inch and a half thick. The exterior row passes behind the furnace, and enters the other row, dividing the air into two parts; so that the blast is carried equally to each tuyere.

The valves placed at *E* regulate the distribution of air, and stop either branch when repairs are required.

In the length of 150 feet, the tubes pass through five furnaces, or heaters, *F, F, F, F, F*, of which two are placed near the tuyeres; so that the air has no time to cool before entering the furnace. Figs. 1 and 2 give an exact idea of the form and disposition of the five heating fires; they are connected by a conduit of brick, *g, g, g*, which envelops the pipes; by this means the flame which escapes from the fireplace, circulates about the pipes, and heats their whole length. To preserve the parts of the pipe immediately in contact with the flame, they are encased in fire brick the whole length of the furnace. In the first apparatus of this kind which was constructed, the ends of the pipes were inserted one in the other, having some play to prevent any rupture by expansion; the result was a great loss of air, and the plan was abandoned. Besides, it was remarked, that a great waste always took place at the joints of the pipes; so that it was not sufficient to fasten them with bolts and nuts; the joints were therefore covered with a ring of iron cast on after they were finished. By means of this precaution, the pipes lasted a long time; at the time of my visit, they had been five months in use without repairs.

On the exit pipes are made small holes, *V, V*, by means of which any change of temperature in the air might be ascertained. This precaution is indispensable, because one of the essential conditions in the use of heated air, is, that its temperature be kept uniform—with this apparatus they raised the air to 612° Fahr., which is higher than the melting point of lead.

In the *Clyde Works*, two of the four furnaces have each an apparatus like the one described, but in the other two there was no room for the extent of pipes, and they are contracted into smaller space, by being doubled upon themselves.

The working of a furnace with heated air, requires no particular precaution; the operation is the same as before its introduction, the only difference consisting in the substitution of raw coal for coke.

This substitution did not immediately follow the adoption of the new plan; it was some time after, and only when the temperature of the air was raised above the melting point of lead, that the immense benefit of the change was discovered, giving a consequent diminution in the expense of manufacture.

The general idea adopted in Scotland, is, that certain qualities of coal cannot be employed crude, except when the air is highly heated. We have already said that at the Monkland Works, where the air is heated to 460° and 490° Fahr., coke is still used.

The descent of the furnace is very regular—the distances between the charges are nearly equal, the charging being regulated by the space left empty in the throat. The richness of the ore not roasted, varies from 22 to 34 per cent., and the composition of the charges follows this variation. At the time of my visit, the average yield of ore, after roasting, was 44 per cent., and the charges thus composed:

660 lbs. coal,
520 lbs. ore roasted.
100 lbs. lime.

They usually made 40 charges in 24 hours. During the two days that I witnessed the working of the Clyde Works, the number of charges were

July 4—from 6, A. M. to 6, P. M.,	38
from 6, P. M. to 6, A. M.	39
6—from 6, A. M. to 6, P. M.,	37
from 6, P. M. to 6, A. M.,	40

The yield of the furnace in these four castings, was,

t.	cwt.	t.	cwt.	t.	cwt.	t.	cwt.	t.	cwt.
4	8;	4	9;	4	6;	4	12.	Total,	17 15

for 154 charges.

Or, 8 t. 17 cwt. 2 qrs. each 24 hours.

This result shows that a ton of iron is produced at an expense of 2 t. 8 cwt. 2 qrs. coal. The consumption of the heating fire is 8 cwt. Total, 2 t. 16 cwt. 2 qrs. per ton of iron.

The castings are made every twelve hours. The metal obtained is usually a mixture of No. 1 and No. 2. That which goes first from the hearth is No. 1. These two varieties of iron are distinguished by the small channels which furrow the surface of the metal while cooling.

The tuyeres are hermetically closed round with clay, and as they cannot resist the elevated temperature to which they are submitted, water tuyeres have been substituted similar to those used in the fineries. The fig. 3, plate 2, represents the tuyeres employed at the Clyde Works; they are of cast iron, and last various lengths of time, averaging five or six months.

The tuyeres are closed in, to prevent the entrance of cold air through the openings. There is no objection to this arrangement, because the air is so hot, that no scoria accumulates upon the pipe, and the workmen are never obliged to free the tuyeres. There is a high white heat in this part of the furnace; nevertheless there are

scarcely any sparks produced by the oxidation of the iron, and the particles that fall are black in the centre, showing that the metal is still covered with a small layer of melted scoria.

The flame issuing from the furnace is of a bright red, while that from the coke furnace, worked with cold air, is of a yellowish colour. This difference of colour is as marked as that which exists between the flame of alcohol coloured by strontia, and by baryta.

The pressure of the blast in the air vessel, is two pounds and a half, or five inches of mercury to the square inch. It is sensibly the same near the tuyeres, only the gauge which indicates it is subject to great oscillations. This pressure was formerly three pounds. The opening of the tuyere is three inches;—it was two inches and a half when cold air was used. The quantity of air forced into the furnace is less. The blowing engine, of seventy horse power, served only three furnaces; now it feeds four with ease. From the dimensions of the blowing cylinder* the quantity of wind, which was 2827 cubic feet per minute of cold air, is now but 2120 cubic feet.

The furnaces of the Clyde have not been altered since the introduction of hot air. They had been in blast a long time when this new plan was adopted; one of them has been seven years in blast, and the regularity of its operations gives an earnest that it will last a long time.

At the commencement of this report, I have already stated the economy of fuel, and of flux, which had been obtained at the Clyde Works, by the introduction of hot air. I think it, nevertheless, useful to show the correctness of the estimate by transcribing a statement of the different expenses of manufacture during a month, while cold air was used, and a corresponding month, with the use of hot air.

I make this statement from the books of the Works, to which I have been allowed access with a rare liberality.

Consumption and produce of three Furnaces using cold air and coke, during the month of February, 1829.

	Coke.		Ore.		Flux.		Pig Iron.			Castings.	Total.					
							No. 1.	No. 2.	No. 3.							
	t.	c.	t.	c.	t.	c.	t.	c.	t.	c.	t.	c.				
1st week	386		227	9	68	2	72	13	32	13	18	13	1	13	125	12
2d do.	411	10	242	11	72	11	51	19	37	11	47	2		6	136	19
3d do.	401		231	16	70	18	44	16	48	2	38	7		3	131	8
4th do.	301	10	177	13	53	6	53		27	9	26	3		0	105	12
	1500		879	9	264	17	222	8	145	15	130	5		2	499	11

Add the consumption of the engine, averaging one ton of slack to the ton of iron made.

* The steam engine which works the blowing apparatus, requires for fuel twenty tons of broken coal, or slack, per day of twenty-four hours, which costs one shilling and eight pence, sterling per ton, (forty cents.)

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Consumption and produce of four Furnaces, using hot air and coal, during the month of February, 1833.

	Crude Coal.		Ore.		Flux.		Pig Iron.			Castings.	Total.	
							No. 1.	No. 2.	No. 3.			
	t.	c.	t.	c.	t.	c.	t.	c.	t.	c.	t.	c.
1st week	516	15	490	7	91	16	81	4	28	15	155	3
2d do.	514		491	6	91	7	48	8	46	15	161	18
3d do.	521	15	486	8	91	8	94	12	59	10	109	8
4th do.	470	10	434	12	81	18	75	2	47	10	102	1
	2023		1902	13	356	9	299	6	182	10	528	10
											1010	6

The consumption of the steam engine averaged eleven cwt. per ton of iron produced.

The result of an examination of these tables is, that for one ton of iron produced, there was consumed as follows:—

1829. <i>With Cold Air and Coke.</i>	1833. <i>Air Heated to 612° Fahr. and Crude Coal.</i>
1. Coal for fusion—	
	t. cwt.
3 tons of coke, corresponding to coal,	2
Do. for steam engine,	11
	8
	7 15
	2 19
2. Ore roasted, 3523 lbs. or	1 15
Its average yield being 57 per cent.	
3. Flux, 1056 lbs., or	10½
	Ore, 3780 lbs. or
	1 18
	Its average yield being 56 per cent.
	Flux, 704 lbs. or
	7

The daily production of the Furnace was

11,904 lbs. or about six tons.

18,035 lbs., or about nine tons.

The daily production having been raised at the Clyde Works from six to nine tons. The introduction of hot air has produced an economy in the consumption of fuel, and in the expense of manual labour.

The following table shows the cost of manufacturing pig iron during these two periods:—

	In 1829. Cold Air.		In 1833. Hot Air.	
	t. c.	d. c.	t. c.	d. c.
Coal for melting, at 5s. per ton, (\$1 20,*)	6	13	2	2 40
do. for the blowing machine, at 1s 8d. per ton, (40 cents,)	2	80	11	22
Coal for the heating apparatus,			8	48
Mineral roasted, at 12s. per ton, (\$2 88,)	1 15	5 04	1 18	5 47
Flux, at 9s. per ton, (\$2 16,)	10	1 08	7	76
Labour, at 10s. per ton, (\$2 40,)		2 40		1 60
General expense, int'st. of capital 6s. (\$1 48,)		1 44		96
Total,		19 74		11 89

* The cost in sterling money is reduced to United States currency at the rate of \$4 80 per pound.—TRANS.

Calder Iron Works.—These works are three miles from Glasgow, on the Edinburgh Road; the hot air blast has been used at them for three years past; two of the furnaces are fed by an apparatus like that at the Clyde Works, but at the other two, the air is heated by means of a system of small tubes, represented in plate 2, figures 6, 7, 8, and 9.

This apparatus is composed of two large horizontal tubes, *a c*, and *a' c'*, six feet long, nine inches in diameter in the clear, and one inch thick. Nine small tubes, six inches in diameter outside, and three inches inside, doubling upon each other like syphons, are placed vertically upon the pipes, *a c*, and *a' c'*, and fastened, by being driven tight into the throat *d*. This system of tubes is placed in a rectangular furnace, ten feet long, three feet wide, and twelve or fifteen feet high. To prevent injury to the joints, care is taken to protect them from the direct action of the fire. The joint *m, n*, of the large pipes is placed outside of the furnace, and the connexions of the small pipes with the large are shielded by fire brick. The flame is carried through the furnace by the longitudinal flue, *g, h*, passing the whole length; it is then spread among the tubes which it envelopes, gaining the chimney by the openings *o, o, o*.

The temperature of the air is raised by this apparatus to 612° Fahr., as at the Clyde Works; the consumption of coal is seven cwt. of coal per ton of iron produced.

This apparatus appears to be preferable to that of the Clyde. It takes less room; the bends in the small tubes, it is true, increase the friction of the air passing through them, but this circumstance appears to have but little influence on its motion. The power expended by the blowing engine is not greater than that at the Clyde Works, and the pressure of the air is two pounds and three-quarters per square inch.

The expense of construction is quite small. The greatest part of it is formed of cast iron, which can be replaced at the works in case of accident. The cost of construction is estimated at about \$150, requiring about seven tons of castings—say about one and a half tons for the large pipes, and five and a half tons for the small tubes. By estimating the iron cast into pipes, at \$24 per ton, which is the average cost at the works using coal, the expense of each apparatus will be about as follows:

Masonry,	-	\$100
Earthen parts of the furnace,		60
Casting pipes,	-	168
		\$328

The expense will then be about \$656 for each smelting furnace. At Calder they estimate the cost at about \$168 to each tuyere. The apparatus at the Clyde is much more expensive;—the quantity of

Consumption and produce of Furnace No. 3 during twelve weeks in 1832 and 1833 by heated air and crude coal.

	Coke.	Ore roasted.	Flux.	Metal.						Total.
				No. 1.		No. 2.		No. 3.		
	t. c.	t. c. q.	t. c. q.	t. c.	t. c.	t. c.	t. c.	t. c.	t. c.	
From 4 Nov. to 2 Dec. 1832	406	379 2	65 5	102 15	62		55 10	220 5		
From 24 Feb. to 23 March, 1833	458 8	389 6 1	64 7 1	116 10	31		52 10	200		
From 24 Mar. to 23 April, 1833	476 4	427 14 1	53 19 1	121 10	36 10		62	220		
	1340 12	1166 2 2	183 11 2	340 15	129 10	170		640 5		
Loss in Ore		797 8								
Crude Ore		1993 10 2								
				Pressure of air, 2½ lbs.						

By comparing these tables, we learn that for one ton of iron produced, the furnace No. 3 consumed as follows:

1828. Cold air & coke.	1831. Air heated to 300° Fahr. and coke.	1833. Air heated to 612° Fahr. and coal.
7075 of coke, corresponding to 15724 lbs. coal, 7 T. 17 cwt.	4279 of coke, corresponding to 9510 lbs., t.cwt.	Coal crude,—
Fuel for heating the apparatus, valued at . . . 6	or 4 15 t.cwt.q.	T. cwt.
Ore roasted 3792 lbs. or 1 T. 18 cwt.	2217 lbs. or 1 7	4187 lbs. or 2 2
Ore crude 5970 lbs. or 2 T. 19 cwt. 2 q.	4575 " or 2 6	Valued at 8
Flux 1330 lbs. or 13 cwt.	1260 " or 12 2	3735 lbs. or 1 17 0
		6228 " 3 0 0
		572 " 5 2

NOTE.—The consumption for the steam engine is not considered.

The furnace has produced each twenty-four hours,

1828.	t. cwt.	1831.	t. cwt.	1833.	t. cwt.
Metal, 11,238 lbs.	5 12½	13,143 lbs. or	6 13	16,428 lbs. or	8 4½

The consumption of combustible has, therefore, diminished from 7 t. 17 cwt. to 2 t. 2 cwt., and the amount of flux from 13 cwt. per ton of iron in 1828, to $5\frac{1}{2}$ cwt. in 1833. This diminution must be charged to the increased temperature in the furnace by the use of heated air. I will indicate at the close of this Report, the reasons which appear to me to account for this increase of temperature, the existence of which is certain, though we have not been able to measure it.

The quantity of air blast has been reduced from 3500 cubic feet per minute, to 2627 feet, the pressure being reduced from $3\frac{1}{4}$ pounds on the square inch, to $2\frac{3}{4}$ pounds.

The expense of the fuel for heating the air, varies from 7 to 8 cwt. per ton of iron.

The consumption for the blast engine remains the same, but as the yield of the furnace has advanced from 5 tons 12 cwt., to 8 ton 4 cwt., the expense, divided on each ton of iron, is reduced from 1 ton 4 cwt., to 14 cwt.; the slack only is used for this purpose.

The consumption of ore has varied much, but, as the scoria never contains more than from .02 to .015 of iron, this difference depends on the quality of the ore, according as the *Ball ironstone*, (mine eu rognous) or *flat ironstone*, (mine eu couche) is used.

At Calder, as in the Clyde Works, the daily production of iron has been increased in a great proportion; this circumstance operates powerfully on the price of fabrication, as will be seen by the following statement.

Cost of making one ton of Pig Iron at the Calder Works.

1828. <i>Cold Air and Coke.</i>			1833. <i>Air heated to 322 cwt. and Crude</i>		
t. cwt.		d. c.	t. cwt.	Coal.	d. c.
7	$17\frac{1}{2}$ coal for fusion, at 4s. 6d. per ton,	8 50	2	2 at 5s. per ton,	2 52
1	4 coal for blast engine, at 1s. 8d. per ton,	48		14 at 1s. 8d.	28
2	$19\frac{1}{2}$ crude ore, at 6s. per ton,	4 25		8 for heating apparatus, at 1s. 8d.	16
	Expense of roasting, at 10s. per ton,	40	1	17 Ore roasted, at 12s. per ton,	5 33
13	Flux, at 7s. per ton,	1 09	$5\frac{1}{2}$	Flux,	46
	Labour, at 10s. per ton,	2 40		Labour reduced in proportion to increase of yield,	1 62
	General expense, interest, &c.	1 44		General expense, interest, &c.	1 01
		18 76			11 38

The blast engine employed at Calder is made with two cylinders, one over the other, with one shaft, so that the pistons of both are attached to the same beam. (*tige.*) The upper cylinder is fifty inches, and the lower cylinder seven feet, in diameter, each being seven feet long; the stroke of the piston, which is nine inches thick, is seven feet, and it makes sixteen strokes a minute.

Monkland Iron Works, near Airdrie.

The heating apparatus used at this establishment is similar to that at Calder, being formed with two large pipes, and a number of small tubes, jointed in the large ones, the relative positions being changed.

The two large pipes, *a b*, *a' b'*, (figs. 4 and 5, plate 2,) are vertical, and framed as shown in the plate. The small tubes, *c' c*, five feet long, which make the communication between them, are placed horizontal. This difference of position, and diminished length of the tubes, prevent the temperature of the air from being raised so high as at Clyde, or Calder.

At the time I visited Monkland, the air was heated to 450° Fah., and coke was still in use for smelting.

The economy in fuel and flux obtained at these works, since the introduction of hot air, is nearly the same as at the Calder works, when the air at that furnace was heated to 300° Fahr., and coke still used in the furnace.

Before the adoption of the new plan, the Monkland works consumed from seven to eight tons of coal, for each ton of metal; since that time, there has been consumed,

<i>t. cwt.</i>	
4	0 of coal for smelting;
6	do. for hot air apparatus;
3	5 crude ore;
	10 flux.

The daily yield is now six tons; the pressure of the blast, two and three quarters of a pound.

The metal produced in the three works of which I have given the details, is, for the most part, intended for the foundry; the No. 3 iron alone is made into bar iron, and for this purpose is sold to the forges near Newcastle.

The pig metal, Nos. 1 and 2, though both destined for the foundries, are not employed indifferently.

The No. 1 iron is principally used for castings, which are to be worked as steam cylinders, &c., or for those requiring great strength. The No. 2 iron, though easily cut with a chisel, is nevertheless harder than the No. 1; it is employed, in preference, for cog wheels, and work requiring considerable hardness.

Besides the works of which I have treated, three others exist in Scotland, using the hot air blast; the results obtained in these establishments, by the adoption of the new plan, being similar to those cited, it appears useless to enter into details respecting them.

Iron Works in the Environs of Newcastle-on-Tyne.

In the coal basin of Northumberland, the largest and richest in the kingdom, which furnishes almost all the fuel used in London, and the vicinity of the Thames, there are but two iron-works:

1st. The *Butterly Iron Works*, six miles from Newcastle, on the London road—the other called the *Tyne Iron Works*, on the banks

of the Tyne, three miles from Newcastle. This region does not abound in good iron ore, and the proprietors have been unable, after the most minute search, to procure mineral enough to supply these two works; but their position on the banks of the Tyne enables them, in spite of these unfavourable circumstances, to draw their supplies from Lancashire and Cornwall, at a cheaper rate than they can be obtained, for the most part, in our iron works.

Both these works have used the heated air for a year past.

The Butterly works, constructed but three years since, contains two furnaces forty-five feet high, four reverberatory furnaces, and several cupolas; all the iron made, is intended for castings.

The results given by the apparatus for heating the air, are not sufficiently important to warrant a particular description and plate. The apparatus consists merely of a tube, returned five times upon itself at right angles, and disposed so that the cross section presents five circles, of which four have for their centres the angles of a rectangular parallelogram, and the fifth the point where the two diagonals intersect.

The tubes are placed horizontally, and are connected by bolts and nuts through lugs on the outside.

The interior diameter of these pipes is fourteen inches, and the metal one and a half inches thick; the length of the heated part is fifty feet, and the pipe is placed in a rectangular furnace, a little shorter than it, so that the joints and angles may not be exposed to the action of the fire.

The expenditure in fuel of this apparatus, is about six hundred weight to the ton of iron produced. The pressure of the air is one and a half pound, being the same as before the introduction of the hot air. The velocity of the blast is a little less.

The charges of the furnace are as follows:

700 lbs. coke, (this coal gives 45 per cent. of coke;)

650 lbs. mineral roasted, being a mixture of equal parts of ore, (*minerai houiller*,) and the red oxide of iron from Lancashire;

400 lbs. flux.

From the register, it appears that there were made, in furnace No. 1,

July 10, 40 charges	} or an average of 40.
“ 11, 42 “	
“ 12, 38 “	

The same furnace produced, in these three days, 23 tons 11 cwt. of metal, or a daily average of 7 tons 17 cwt.

By taking this data, we find that, to make one ton of iron at Butterly, they consume,

4 tons of coal for fusion;

6 cwt. coal in lumps to heat the air;

1 ton 13 cwt. ore roasted;

1 ton flux.

The quantity of flux employed is very considerable, because it is much charged with water, being a marly chalk, brought from the banks of the Thames, by the coal ships.

Fig. 1.

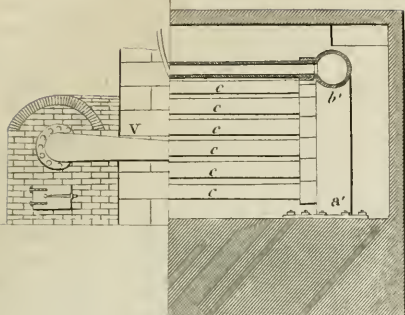


Fig. 5.

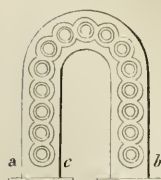


Fig. 7.

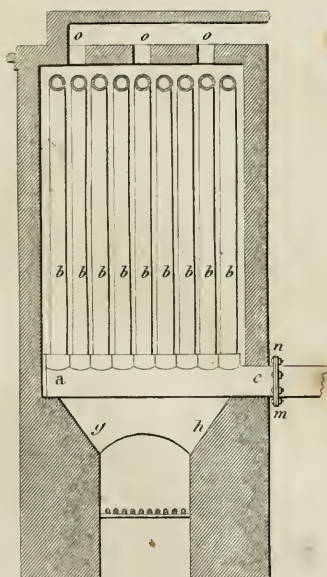


Fig. 8.



Fig. 3.

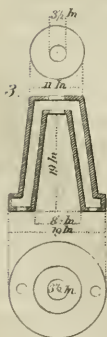
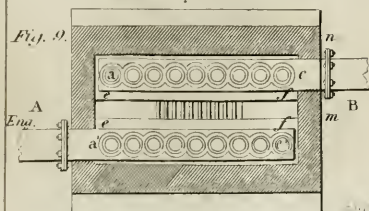


Fig. 9.



Plan

Fig. 1.

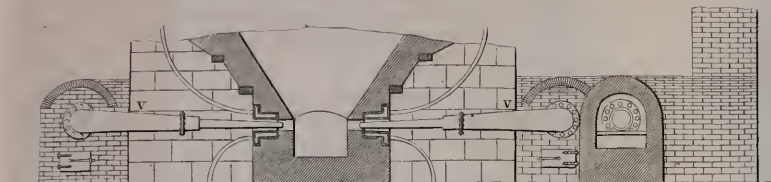


Fig. 1.

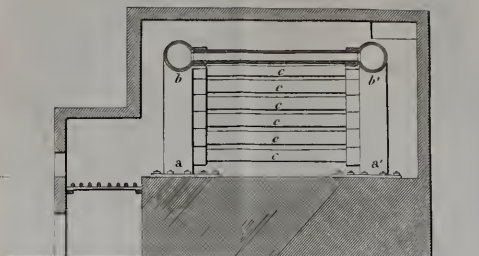


Fig. 5.



Fig. 2.

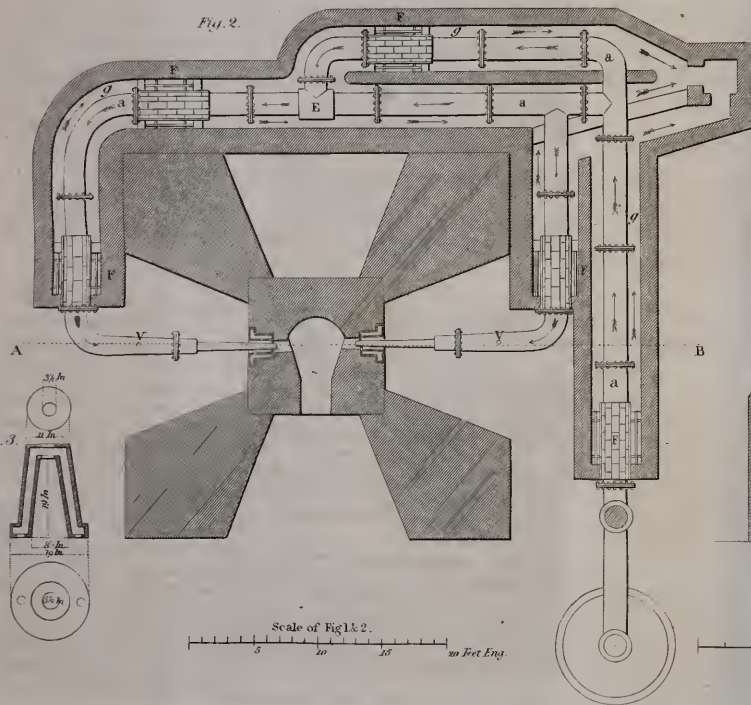


Fig. 6.

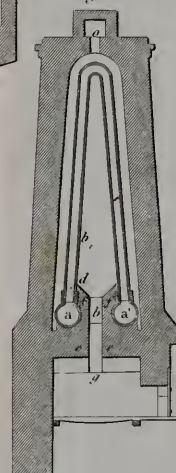


Fig. 7.

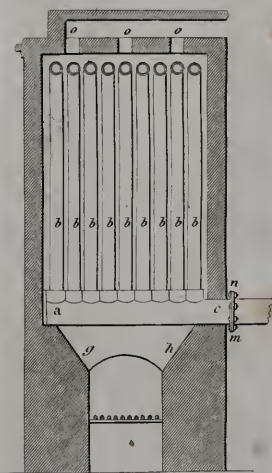


Fig. 8.

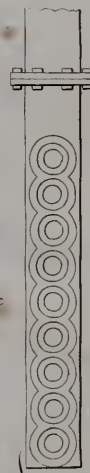
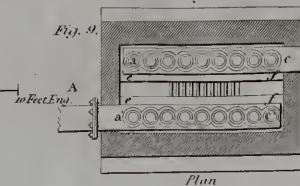


Fig. 9.



Scale of Fig. 4 to 8.

10 Feet Eng.

Plan

The mixture of ore, when roasted, contains 60 per cent. of iron.

To appreciate the saving which has resulted at the Butterly works, from the use of hot air, it is necessary to know exactly the consumption for a ton of iron, before the introduction of the plan. I have not been able to procure documents which would furnish this; but Mr. J. Hunt, the manager, assured me that the expenditure was seven tons of coal.

If we compare these results with those obtained in Scotland, we shall find that the consumption at Butterly corresponds nearly with that at Calder in 1830, when the temperature of the air was raised to 300° Fahr., and coke was still burned.

At Newcastle, the price of coal forbids its use in the crude state, because the lumps, which are worth one dollar and forty cents the ton, must be used; while the slack, at forty cents, may be used to make coke for this purpose. It is nevertheless advantageous to give the air a higher temperature.

Tyne Iron Works.—The consumptions of material in this work, for the production of a ton of metal, are nearly the same as at Butterly; but an important difference existing between these establishments is, that, at the Tyne works, a great portion of the pig metal is made into malleable iron. This iron, which is of a superior quality, is almost exclusively rolled into boiler plates. In the same furnaces, and with the same minerals, the two kinds of iron are made by varying the relative proportions of ore and coke.

Cupolas are also fed with heated air to great advantage, 225 pounds of coke being sufficient to melt a ton of metal.

The furnaces having been constructed since the adoption of the hot air plan, no comparisons in regard to economy could be instituted.

Environs of Manchester and Liverpool.

The *Rant* iron works, near Wrexham, in Flintshire—the *Apdale*, the *Laneend*, and the *Silverdale* works, near Newcastle-under-Line, Staffordshire—have adopted the hot air plan.

The apparatus used in these establishments, are very like those represented in plate 2, figs. 7 and 8. At Apledale, precisely the same apparatus is used, and the results obtained since its introduction are almost identically the same as at Calder, the temperature of the air being raised to 600 or 612° Fahr.

The consumption of coal, formerly six tons to the ton of iron, is now reduced to three and a quarter tons. They still employ coke, the coal being sulphurous. The expense of the heating apparatus is 7 cwt. of coal to the ton of iron.

The quantity of flux is reduced in the same proportion. In July, when I visited Apledale, only one furnace was in blast, which had been five years at work, but only six months with heated air. Since that time, the yield of the furnace has been from six to seven tons per day; the iron produced being almost all No. 1; while before, the metal had been nearly equal parts of No. 2 and No. 3, the last being made into bar iron.

One work near Newcastle, belonging to Mr. Furnstone, has aban-

doned the use of the hot air blast. I should have endeavoured to ascertain the cause of this, had I learned the fact in time to visit the works.

(*To be continued.*)

¶ *Laws of Motion of Steam Vessels.* By P. W. BARLOW, Esq., Civil Engineer.

The author commences with the description of a paddle wheel for steam vessels, of a new construction, in which the floats are made to enter and leave the water nearly in a vertical position. He then investigates several formulæ adapted to the calculation of the forces and velocities arising from this form of the apparatus, and gives an account of the results of various experiments made on its efficiency, as compared with the common wheels, and with relation to the consumption of fuel. The general results to which he is led are as follows: 1st. When vessels are so laden as that the wheel is but slightly immersed, little advantage is derived from the vertically acting paddles. 2dly. In cases of deep immersion, the latter have considerable advantage over the wheel of the usual construction. 3dly. In the common wheel, while the paddle passes through the lower portion of the arc, that is, when its position is vertical, it not only affords less resistance to the engine, but is less effective in propelling the vessel than in any part of its revolution. 4thly. The paddle of the wheel, while passing through the lower portion of the arc, affords more resistance to the engine, and is more effective in propelling the vessel, than in any part of its revolution; a property which is a serious deduction from its value; for, in consequence of the total resistance to all the paddles being so much less than in the common wheel, much greater velocity is required to obtain the requisite pressure, and a greater expenditure of steam power is incurred. This loss of power is most sensible when the wheel is slightly immersed; but in cases of deep immersion, the vertical paddle has greatly the advantage. 5thly. In any wheel, the larger the paddles, the less is the loss of force, because the velocity of the wheel is not required to exceed that of the vessel in so great a degree, in order to acquire the resistance necessary to propel the vessel. 6thly. With the same boat, and the same wheel, no advantage is gained by reducing the paddle so as to bring out the full power of the engine; the effect produced being simply that of increasing the speed of the wheel, and not that of the vessel. 7thly. An increase of speed will be obtained by reducing the diameter of the wheel, at least within such limits as allow of the floats remaining sufficiently immersed in the water, and provided the velocity of the engine does not exceed that at which it can perform its work properly. 8thly. An advantage would be gained by giving to the wheel a larger diameter, as far as the immersion of the paddles produced by loading the vessel would not so sensibly affect the angle of inclination of the paddle; but this advantage cannot be obtained with an engine of the same length of stroke, because, in order to allow the engine to make its full number of strokes, it

will then be necessary to diminish the size of the paddles, which is a much greater evil than having a wheel of smaller diameter with larger paddles.—*Proceedings of the Royal Society.*

[*Rep. Pat. Inv.*]

¶ *Professor Turner's Experiments on the Action of High Pressure Steam on Glass.*

The following is an abstract of a notice of some experiments recently made by Dr Turner, Professor of Chemistry in the University of London, on the action of high pressure steam on glass and on several other substances, which was read before the Geological Society on the fourth of June last. The facts which it recites will serve further to illustrate the nature of glass, and the circumstances of its decomposition. We shall probably return to the subject on a future occasion.

An opportunity having presented itself to the author, of including substances in a high pressure steam boiler, he took advantage of it to try the effect which would be produced on glass, and he accordingly encased in wire gauze some specimens of plate and window glass [the latter being *crown glass*, we presume,] and suspended them from the top of the boiler, so that they were surrounded by steam whenever the boiler was in action. They were kept in this situation for four months, during which time the boiler was commonly in action ten hours daily, except Sundays, its temperature being then at 300° Fahr. On opening the boiler at the end of the time specified, all the pieces of glass were found to have been more or less decomposed; and the plate glass in particular, which is a glass of silex and soda, was far advanced in decomposition. Flat pieces, one-fifth of an inch thick, were in some parts decomposed through their whole substance; while in others, a layer of unchanged glass was found in the middle, covered on each side with a stratum of opaque, white, siliceous earth, having the appearance of chalk.

The author referred these changes to the influence of water on the alkaline matter of the glass. The white, earthy portions were found to be entirely free from alkaline matter, which had been dissolved and removed by the water which condensed upon the glass at the successive heating and cooling of the boiler, or which may have been thrown upon it by splashing during ebullition. But the author considered that the actual loss was not due to the extraction of alkaline matter only, but that the silex of the glass had in some measure been dissolved along with the alkali. This was proved to have been the case by the apertures of the gauze envelope being filled up at the most depending parts by a silicious incrustation, where also a stalactitic deposit of silica, about one inch and a quarter long, had formed.

A piece of window glass [crown glass] included at the same time with the plate glass, was in a decomposing state, but in a much lower degree. A piece of rock crystal, confined in a boiler at the same time, was wholly unchanged.

The author adduced these facts to illustrate the action of water at high pressures on felspathic and other rocks containing alkaline matters.—*Proceedings of the Geological Society.*

[*Ibid.*

¶ *Rail-road in Egypt.*

A Paris paper contains a letter from Alexandria, which states that this rail-road is to commence at Choubrah, will pass near to Cairo, and thence by the sides of Mokotam, to its termination at Suez. Goods landed at Alexandria, are to be sent by steamboats to Alfe, by the canal of Mack-Modie, and from thence to Choubrah, by the Nile. From Choubrah they will be conveyed by wagons to Suez, whence they will be passed on by steam to Bombay.

[*Lond. Mech. Mag.*

Extract of a Letter to the Editor, from a Correspondent at the University of Virginia, dated Feb. 11, 1835.

“On Saturday night last, the thermometer sank to six degrees, a degree of cold unprecedented, so far as I know, in this place. It may be proper to mention, that the instrument which gave this indication was exposed to the clear sky. Another, also out of doors, but fastened to the inside of a venetian blind, so as to learn the loss of heat by radiation interrupted, did not sink below zero. Observers should be aware of this cause of difference.

During the cold in January, which was so excessive at the north, I did not see the thermometer below $+ 10^{\circ}$. I am informed that, during the whole of this period, the weather, west of the Allegheny Mountains, in this State, was quite mild. I do not know, indeed, of any thermometrical observations, but the extraordinary fact is sufficiently shown by the circumstance, that there was no ice for the ice houses, and that great uneasiness was expressed lest the usual supply of this luxury for the next summer, should fail. You know that the climate is generally much colder to the west than to the east of the mountains in this State.”

List of American Patents which issued in January, 1835.

	Jan.
1. Cooking Stove.—Abraham Spoor, Coxsackie, New York,	7
2. Stoves for anthracite. do. do. do.	7
3. Churn.—Iram Brewster, Schoharie county, New York,	7
4. Thrashing machine.—Luke Hall, Hollis, New Hampshire,	7
5. Cooking stove.—Eliphalet Nott, Schenectady, New York,	7
6. Covering vessels with caoutchouc.—George D. Cooper, N. York city,	7
7. Pendulum lever engine.—Sidney Woods, Freeport, Maine,	7
8. Cutting clothes.—Allen Ward, Philadelphia,	7

	<i>Jan.</i>
9. Churn, spiral spring.—Lewis Hinkson, Hallowell, Maine,	7
10. Cotton gins, improved.—Wm. S. Cooley, Norwich, Connecticut,	7
11. Woodworth's planing machine, improved.—Artemas L. Brooks, Lowell, Massachusetts,	7
12. Ink distributor.—John Maxson, Schenectady, New York,	9
13. Portable press.—Alex. J. Murray, Annapolis, Maryland,	9
14. Mills, propelling by weights.—Obed R. Marston, Java, New York,	9
15. Churn.—Francis Colton, New York city,	9
16. Cylinder pump, double acting.—Phelps Mix, Germantown, Pa.	9
17. Window springs.—Munro L. Stevens, Waterbury, Conn.	9
18. Open stove, &c.—Elias W. Newton, Middletown, Connecticut,	9
19. Stoves, manufacturing. do. do. do.	9
20. Rake tooth machine.—G. Dayton & W. Stedman, Blanford and Spring- field, Massachusetts,	9
21. Rotary steam engine.—Ethan Baldwin, Washington city,	9
22. Nail machine nippers.—Stephen Chubback, Wareham, Mass.	9
23. Horse power.—Irby Jones, Natchez, Miss.	9
24. Cracking coffee berries.—Isaac Adams, Boston, Mass.	9
25. Cracking coffee husks.—Thomas Ditson, Boston, Mass.	9
26. Percussion cannon lock.—Robert Beale, city of Washington,	13
27. Clover seed, hulling.—Stacy West, Hartford county, Maryland,	16
28. Churning and washing machine.—Ira Parke, Delhi, New York,	16
29. Dyspepsia machine.—Charles Wood, New Bedford, Mass.	16
30. Cooking stove.—Sylvester Parker, Troy, New York,	16
31. Cooking stove.—John Iggett, Albany, New York,	16
32. Stump extractor.—Henry Gordon, Fountain Dale, New York,	16
33. Washing machine.—Stillman Roberts, Portland, Maine,	16
34. Horse power band.—J. L. Stanly and J. C. Howard, Winthrop, Maine,	16
35. Currying knife trimmer.—Luther Townsend, Farmington, Maine,	16
36. Sausage machine.—J. Burns and J. Walton, Waynesboro, Pa.	16
37. Trunks and settees.—Benj. Morris, N. Richmond, Ohio,	16
38. Bee-hive.—Samuel Morrill, Dixfield, Maine,	16
39. Iron furnaces, anthracite.—M. Brooke Buckley, Pottsville, Pa.	16
40. Bedstead machine.—Aaron Stedman, Pittsford, New York,	16
41. Hoops and masts, &c. bending.—Jonathan Mulford, N. Liberties, Pa.	16
42. Corn shelling machine.—Robert Gray, Northfield, New Hampshire,	16
43. Grist Mill.—Hezekiah and Pouncey Nichols, Barren county, Ky.	21
44. Stave saw.—Harvey Holmes, N. Marlborough, Mass.	21
45. Straw cutter.—Nimrod Murphree, Nashville, Tenn.	21
46. Water cisterns.—Levi Kidder, New York city,	21
47. Barrel machine.—John Squier, Saline, New York,	21
48. Press for hay and cotton.—Eben. Eliason, Jr., Fredericksburg, Va.	21
49. Truss hoops.—T. and S. Burgess, Livonia, New York,	21
50. Fireplace.—Ansel Gerrish, Shopleigh, Maine,	23
51. Smut and garlic machine.—Abraham Hurst, Allen township, Pa.	23
52. Thrashing and cleaning machine.—Alexander Porter, New Vineyard, Maine,	23
53. Stove for anthracite.—Jacob J. Janeway, New Brunswick, N. Jersey,	27
54. Setting awl blades, &c.—E. B. Bigelow and S. P. Brigham, Boylston, Massachusetts,	27
55. Rotary pump.—Wm. C. Trowbridge, South East, New York,	27
56. Propelling boats.—Philip E. Barbour, Louisville, Kentucky,	27
57. Mill, farmers'.—John R. Sleeper, city of Philadelphia,	27

CELESTIAL PHENOMENA, FOR APRIL, 1835.
Calculated by S. C. Walker.

Day.	H'r.	Min.	
2	7	11	N. App. 53 Tauri, ,6,7, and ☽, * N. 1',6
4	11	25	Im. 5 Geminorum, ,7, N. 26° V. 78°
4	11	57	Em. 324° 14°
10	13	23	N. App. ♄ Virginis, and ☽, * N. 3',5,
12	6	13	Im. 65 Virginis, ,6, 33° 545°
12	7	7	Em. 265° 216°
12	6	58	Im. 66 Virginis, ,6, 100° 50°
12	7	42	Em. 210° 162°
30	8	41	N. App. Jupiter's Centre. and ☽, ☽ N. 7,'4

Meteorological Observations for December, 1834.

Moon.	Days.	Therm.		Barometer.		Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise.	☉ P.M.	Sun rise.	☉ P.M.	Direction.	Force.		
☾	1	3 1/2	4 3/4	30.10	30.05	SW. S.	Calm		Clear—lightly cloudy—rain in n'l.
	2	4 0	4 5	29.70	29.60	S. SE.	Moderate.	0.27	Rain—drizzle.
	3	3 32	4 0	.70	.75	W.	Brisk.		Lightly cloudy.
	4	3 25	3 36	30.20	30.25	W.	Moderate.		Clear day.
	5	3 56	4 6	.15	.13	W. SW.	do.		Clear—bazy—rain in night.
	6	5 2	5 0	29.40	29.40	SW.	Brisk.	1.00	Rain—cloudy.
	7	3 36	4 6	30.00	30.00	W. SW.	Moderate.		Clear day.
	8	4 6	4 3	29.60	29.55	SW. W.	Brisk.		Cloudy—lightly cloudy.
	9	2 29	3 36	30.15	30.20	W.	Moderate.		Clear—cloudy.
	10	2 24	3 4	.35	.35	S. SW.	do.		Clear day.
	11	2 24	3 2	.05	.09	W.	do.		Clear day.
	12	3 32	3 6	29.35	29.35	W. SW.	Brisk.		Cloudy day.
	13	3 32	4 0	.60	.65	SW.	do.		Cloudy day.
	14	3 36	3 0	.56	.65	W. NW.	Blustering		Cloudy—clear at 10 P.M., therm.
	15	2 7	18	30.00	.55	NW.	do.		Cloudy—sun eclipsed. [5 above 0.
	16	2 28	3 0	29.65	.70	W.	Moderate.		Cloudy—clear.
	17	1 16	2 1	30.20	30.30	NE.	do.		Lightly cloudy.
	18	1 24	3 0	.15	.15	NE.	do.		Cloudy day.
	19	3 0	3 6	.26	.30	NE.	do.		Cloudy day.
	20	3 0	3 6	.00	.00	SW.	do.		Cloudy day.
	21	3 32	3 36	.10	.15	W.	do.		Cloudy day.
	22	3 36	4 3	.20	.10	SE. SW.	do.		Cloudy day.
	23	3 0	4 2	.10	.15	W.	do.		Cloudy—lightly cloudy.
	24	3 30	3 1	.10	.29.30	E.	do.	0.33	Sleet—drizzle—rain.
	25	3 30	3 0	29.77	.75	SW.	do.		Cloudy day.
	26	3 16	3 0	.55	.90	NE.	do.		Snow.
	27	3 0	3 0	.30	30.00	W.	do.		Cloudy day.
	28	2 36	2 0	29.30	.15	SE.	Brisk.	0.75	Cloudy day.
	29	2 36	2 0	29.30	.70	NE.	Brisk.		Snow.
	30	2 30	3 5	.70	.80	W.	Moderate.		Cloudy day.
☾	31	3 0	3 7	.70	.80	W.	do.	2.35	Cloudy—lightly cloudy.
☾	Mean	28.57	36.03	29.94	29.94				

Thermometer.

Maximum height during the month, 53. on 6th,
Minimum do. 7. on 15th.
Mean do. 32.30

Barometer.

30.35 on 10th.
29.40 on 6th.
29.94

JOURNAL
OF THE
FRANKLIN INSTITUTE
OF THE
State of Pennsylvania,
DEVOTED TO THE
MECHANIC ARTS MANUFACTURES, GENERAL SCIENCE,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

APRIL, 1835.

Address upon a proposed Rail-road from Wilmington to the Susquehanna, together with a Report of the Survey made by William Strickland, Esq., Architect and Engineer.

(WITH A MAP.)

The route through Wilmington, Elkton, North East, and Charles-town, to the Susquehanna river, has been, from the earliest settlement of the country, an established route in the great chain of communication running through Philadelphia and Baltimore. It is the shortest road between these two cities, and, until the establishment of the steamboat and rail-road line through Newcastle and Frenchtown, was the most expeditious, and, as such, was the regular route for the transportation of the United States Mail. In the winter season, when navigation ceases, it is still the line by which that mail travels. The peculiar advantages which this route possesses over all others, points it out as the natural thoroughfare over the peninsula, available at all seasons of the year, the shortest, and, when the proper artificial means are applied, the most expeditious. Convinced of these facts, the attention of intelligent individuals in Wilmington has for many years been directed to the subject of a rail-road communication along this route, as one which would at once unite great public convenience and utility, with a profitable investment of capital. An act of incorporation was obtained from the legislature of Delaware, in the year 1832, authorising a company, with a competent capital, to construct a rail-road from Wilmington to the line of the state of

Maryland, in the direction of the Susquehanna; and in the same year, a similar act was granted by the legislature of Maryland, providing for a continuation of the road through that state; and, by provisions in their respective charters, the two companies are authorized, after their capital shall be subscribed, to unite their stocks, and form one company. The capital authorized to be created in each state, is \$400,000. The charters in both states are perpetual. Circumstances which it is unnecessary to detail, have delayed the serious prosecution of this undertaking until within a few weeks past. In the beginning of January, a committee, appointed by a town meeting of the citizens of Wilmington, employed William Strickland, Esq., of Philadelphia, to make a survey of the route from Wilmington to the bay of North East, who, having performed that duty, has submitted a report, which realizes all our anticipations of the facility and moderate expense with which an easy and excellent rail-road, shorter than the post road, may be constructed. Of this survey, as it is intended that Mr. Strickland's report shall accompany this, all the circumstances are so fully explained in it, that the committee will here simply refer to it, and pass on to a brief explanation of the advantages of this undertaking, and the inducements it presents as a profitable investment of capital.

The peculiar advantages belonging to a rail-road by this route, are: First—Its shortness. Second—Its capacity for constant use at all seasons of the year. Third—Its connection with the river Susquehanna. Fourth—The character of the country through which it passes.

And 1st—*Its shortness.*—The whole distance from Philadelphia, through Wilmington and Elkton, to Charlestown, at the head of the bay of North East, is one mile less than the distance to Frenchtown, by the way of the river Delaware and Newcastle. From Charlestown it is but five miles to the Susquehanna ferry, opposite to Havre-de-Grace, and thence thirty-six miles to Baltimore. As a mixed steamboat and rail-road route, the distance from Philadelphia, through Wilmington, to Charlestown, is but three miles greater than the distance through Newcastle to Frenchtown; and the distance from Frenchtown to Baltimore is fifty-six miles, while from Charlestown to Baltimore it is but fifty miles, making a difference of six miles in favour of this route, in the whole distance. Thus much for the actual distance. In point of time, the advantages of this route consist in nearly ten miles more of rail-road travel, of an excellent landing at Charlestown, and an open navigation, entering at once into the bay, without obstructions of any kind. In point of shortness, then, both of distance and time, the committee express a confident opinion that there is no route between the two cities which will compare with this.

2d—*Its capacity for constant use in all seasons of the year.*—Although the present survey has stopped at the bay of North East, the acts of incorporation contemplate an extension of the road to the Susquehanna, and the company, when organized, will undoubtedly deem it their interest to carry into effect the intention of the law.

The termination of the road, according to the present survey, at Charlestown, will be but five miles from the Susquehanna ferry, opposite to Havre-de-Grace, and is in the direct line to it. It has been ascertained that the extension of the rail-road to that point is practicable and easy. In view of these facts, it is obvious that, during the obstruction of the navigation in the winter season, this route must of necessity be the thoroughfare across the peninsula, available in all weather, and from that circumstance, securing the transportation of the mail, and the carriage of passengers. As connected with this view of the subject, it may be proper to add, that there is a law of Maryland authorizing the construction of a rail-road from Baltimore to Havre-de-Grace, which has been already surveyed, and that there is at this time an excellent turnpike road from Baltimore to Bush, about eleven miles from Havre and Port Deposit.

3d—*Its connection with the river Susquehanna.*—The probability, indeed, we may say, the ultimate certainty, of such a connection, has been adverted to in the preceding paragraph. Such a connection, by opening an avenue for the transportation of the vast produce of the Susquehanna on this road, presents advantages too obvious to render any illustration necessary.

4th—*The character of the country through which it passes.*—The route is laid through a populous and well cultivated district, and one which is probably not surpassed by any other of the same extent in the union, in the number of mill seats abundantly supplied with water. A great deal of this mill power is now applied to various and valuable manufactures of cotton, wool, iron, and flour, and the introduction of so ready an access to a market as the rail-road will present, cannot fail to bring into requisition and use, a great amount of manufacturing power, that is now unemployed.

Wilmington itself is situated in the midst of a great manufacturing district, embracing almost every species of valuable manufactures in our country. The vast manufactures of the Brandywine, in powder, flour, cotton, wool, and paper, will furnish a large amount of transportation for the road. Two large and valuable steamboats are owned in the place, and have for several years carried on a profitable business, in passages and freights. They would at once constitute a good beginning of a steamboat line, being already engaged in a regular and profitable business.

These advantages the committee present as peculiar to this route, of which it cannot be dispossessed or deprived by any competition. Adverting to others of a general character, in which a fair competition is to be encountered, they cannot see the slightest reason to doubt its ability to sustain itself. As an important connecting link in the great chain of artificial communications, passing from New York, through New Jersey and Pennsylvania, and through Maryland to the river Ohio, it cannot but obtain a fair proportion of the immense and increasing mass of travellers who are constantly passing north and south, on these great thoroughfares. The number of passengers over the Newcastle and Frenchtown rail-road, within the last year, is said to have been 100,000; and the rate of increase is

estimated at ten or twelve per cent. annually. The rapid increase of population in our country, combined with the rapidly increasing facilities of communication, give abundant assurance that this increase will steadily progress. From what has been previously stated in this address, we deem it fair to say, that the Wilmington and Susquehanna Rail-road may justly claim a moiety of this vast amount of business—a proportion which, with the exclusive sources of business and profit already adverted to, will, it is believed, amply repay the investment.

The committee conclude by referring to the report of Mr. Strickland, which is appended, for details relative to the practicability, length, and expense of constructing the road, and for other particulars connected therewith.

Wilmington, Feb. 17, 1835.

JAMES CANBY,	} Committee.
JOHN WALES,	
W. B. BROBSON,	
DAVID C. WILSON,	
H. WHITELEY,	
JAMES SEWALL,	
T. S. THOMAS,	

Philadelphia, Feb. 11, 1835.

SIR,—I have the honour to transmit to you my report and estimate of the cost of constructing a rail-road from the city of Wilmington to the bay of North East.

These documents are accompanied with a map and section, exhibiting the route and grade of the road, together with the principal streams, common roads, and towns, which lie in, and are adjacent to, the track.

There are twelve printed copies of the report, one for each member of the Committee of Survey; no more will be printed, unless so ordered by you; and when the lithographic map is finished, it is intended that it should accompany the report, as a means of more comprehensive illustration.

In the specification and estimate, you will perceive that I have comprehended all the items necessary to make a perfect and substantial road, including store-houses, wharves, and fencing in of the whole line; in short, every thing, except locomotives and car machinery.

As soon as the navigation opens, it is my intention to send to the Committee of Survey a specimen of the kind of edge* rail which is



* This rail was invented some years ago, by Samuel V. Merrick, Esq., of Philadelphia, and was favourably reported on by the Committee on Inventions, of the Franklin Institute. The first rails of this form were rolled in England, from drawings made by him. The annexed cut exhibits a transverse section of the rail; it evidently combines greater stability and strength, with less weight of material, than any other edge-rail yet devised.

embraced in the estimate. It is of the most simple character, combining substance and strength, where these properties are most requisite. I hope the committee will not make a choice of wooden string pieces, merely on account of the difference in the cost, which is of no importance, compared with the permanence and lasting properties of the *iron edge rail*; particularly so, when we consider that the road is to be so great a thoroughfare for light and rapid transit, as well as for heavy trains of burthen cars.

The estimate is made with great care, and will cover every thing in a substantial and workmanlike manner; such as it ought to be, both for economy, as well as permanency and duration; at least, it is such as I will not hesitate to contract for and completely finish in all its parts.

With great respect, &c.

WILLIAM STRICKLAND.

To JOSHUA GILPIN, Esq.,

Chairman of Comm. of Superintendence,
Kentmere, Brandywine, Delaware.

REPORT.

Wilmington and Susquehanna Rail-road.

TO THE COMMITTEE OF SURVEY.

GENTLEMEN,—Your instructions of the eighth of January last, requiring the survey of a route for a rail-road between the city of Wilmington and the bay of North East, have been complied with, and I have now the honour to report to you a map of the country, containing the course and sectional grade for a rail-road between these two points.

Having had the advantage of an early acquaintance with the topography of this district of country, between the bays of the Delaware and Chesapeake, it was not in the least difficult for me, in the commencement of the exploration, to determine the general course, that would at once combine straightness with the least irregularity of surface; with a single view, therefore, to these characteristics of a good route for a rail-road, I have succeeded, I think, in tracing a line combining the lowest grade with the shortest direction.

It has been suggested that a more direct and eligible route might be obtained for a rail-road on the southern banks of the Christiana creek, by crossing this stream at Wilmington, and pursuing a course to the south of Iron hill, to a point near Elk landing, and from thence to North East, by the valley of Mill creek.

There is not, perhaps, in any other district of the union, an equal area of country embracing so many mill seats, with a bountiful supply of water, as that portion of Newcastle county which is contained within the quadrant circle of the twelve miles radius. Agricultural products, and manufactures of various kinds, abound on the tributaries which flow in upon the northern banks of the Christiana; and the

route for a rail-road, as laid down on this side of the stream, passes through a populous country, where mill power is applied to a great extent, and where the means of communication with a market like the route under view, will always command a great accession of freight and passengers. But few of these advantages exist on the southern side of the creek, and a single glance at the accompanying map will show that nothing, in point of distance, can be gained by this proposed route.

First Division.—On leaving Wilmington, it is necessary, in order to avoid the marshes on the northern side of the creek, to pursue a line of great curvature along the margin of the fast land, to a point below Moody's. At Moody's, there is no difficulty in making a choice between a level bottom and upland, where the line is laid in nearly a straight direction to Newport and Stanton. The surface of the country back of these town is entirely too high and undulating to pass out from the valley of the Christiana. Stanton lies nearly in the straight line from Wilmington to Elkton, and Newport is a little south of this line. A surface of ground of great uniformity, and upon a dead level, is obtained by the way of Latimer's woods, and the foot of Indian hill, through the town of Newport, Wardell's, and *Bread and Cheese* Island, to the Red Clay, at Stanton. This division of the route is five and a half miles in length, and can be laid at a small expense.

Second Division.—At the crossing of the Red Clay, near Bailey's mill, the banks of the opposite shores of this stream approach within 150 feet of each other, where a bridge of 75 feet span can be easily and cheaply constructed. From Stanton, Ogle-town is to the south of the same straight line to Elkton, and the route traced, passes through the bottom land of White Clay creek, on the north side of the stream; it crosses Mill creek near the barn of Dr. Reynolds, and proceeding through Francis and James Denny's land, it passes the White Clay at Morrison's, near Price's mill, from whence it continues in nearly a direct course, rising at a grade of about twenty feet to the mile, to the north bank of Ogle's run, near the bark mill, which is but a short distance from Ogle-town, on the road to Newark. This division of the route is four and a half miles in length, three of which is nearly level, and exceedingly easy of execution. Mill creek will require a bridge of seventy-five feet span, with embanked approaches of moderate length, and about twenty-five feet in height. The White Clay bridge must consist of five spans, of seventy-five feet each, with short embanked approaches of twenty feet in height.

Third Division.—On leaving the bark mill near Ogle-town, the same direct line heretofore mentioned as our guide to Elkton, passes between Iron and Chestnut hills, near Tyson's mill and ford; these hills are directly in the route to Elkton, and are connected together by a link or ridge of land, entirely too high for the passage of the rail-road. To pass round Iron hill to the southward, would require a great degree of aberration and curvature from the direct course, and, consequently, an increase of distance; the nearest approach,

then, to the straight line from the bark mill, onward, is by the northern foot of Chesnut hill, to the ravine of Persimmon run, at its junction with the head of the Christiana creek, below the forks. This division of the route is three and a half miles in length, upon an ascending and easy grade of about twenty feet to the mile. It will require but small bridges to pass Ogle's run, and the Christiana creek.

Fourth Division.—Pursuing the ravine of the Persimmon, which skirts the northern slope of Chesnut hill, the route crosses at the tangent point, or commencement of the circular line between the states of Delaware and Maryland, and rises by an easy grade to the level of the table land near the road leading from Newark to Elkton. It passes the summit about half a mile to the eastward of the old canal feeder, and gradually descends, at the grade of twenty-five feet to the mile, into the valley of Cow run, near the foot of Bell hill, at Ricketts', and crosses the Big Elk below Gilpin's ford, in nearly a straight course towards the Little Elk. Here the line leaves the town of Elkton about three quarters of a mile to the southward, where a branch line may be made to curve into the town upon a dead level. The fourth division extends to the Little Elk at Crawford's mill, and is six miles in length; it passes the summit about midway between the Persimmon and Elk, and upon very even and favourable ground. The passage of this stream will require a bridge of five spans, each seventy-five feet in length, with an embanked approach on the eastern side of the creek, of 800 feet, by twenty feet in height. The Elk is wild and impetuous; it runs through extensive flats, which are subject to overflow, and great care must be taken to promote a free passage for the water. The Little Elk is also of the same character, but a much smaller stream. Two spans of seventy feet, with short embankments, eighteen feet in height, will be sufficient at this pass. The ground upon which the line is laid, between these streams, is exceedingly favourable, and forms a level esplanade for the whole distance to the north and west of the town of Elkton.

Fifth Division.—After crossing the Little Elk on the south of the post road, the line curves towards Mill creek valley, and there it is laid in nearly a straight line through the barrens of this stream, for the distance of three miles, upon a rising grade of thirty feet to the mile. The ground to the right and left of this portion of the line, as far up the valley as M·Vay's, is very rough and undulating, and gives us no choice but to pursue the course of the stream. The numerous small runs of water which come in from the ridges on both sides of the line, must be led off by wide ditches and drains. M·Vay's is situated at the foot of the eastern slope of Bacon hill, where the ridge, or highest point of land, divides the waters of the North East river and the Little Elk. At this place, the valley of Mill creek continues in nearly a straight course, and rises rapidly to the summit of Bacon hill. From a distant view of this hill, it would seem to

afford a low pass in a direct line to the town of North East; but from a trial line of level, it proved to be entirely impracticable, being nearly 170 feet above the tide, and but two miles distant from the contemplated western termination of the road, on the river, at Simper's point. However desirable an object it might be to keep up, for this short distance, the existing straight and uniform direction of the route from Wilmington to the river at North East, I regret that it could not be effected but by resorting to a long deep cut, or tunnel, and the necessity of inclined planes on the western descent to the river. A resort to fixed machinery of any kind, on a public line of road, is highly objectionable, as it creates a never-failing source of expense, delay, and danger.

By curving the route to the northward, at a point in the line below M-Vay's, Bacon hill may be avoided altogether, and a pass through a sandy ridge can be had, by an average amount of cutting to the depth of twenty-two feet, for a distance of about 1800 feet in length. After passing this ridge, which is found to be about thirty feet lower than that at Bacon hill, a reversed curve of large radius will lead the line into a straight course toward the town of Charlestown, by crossing the North East river at a point between the forge and the town. This inclination to the northward will be highly favourable to the ultimate continuance of the route toward the ferry on the Susquehanna, opposite Havre-de-Grace. Simper's point is one mile below the town of North East, and is situated at the head of the navigation of the bay; the river between this point and the town, is made up of shoal water, and extensive mud flats.

Charlestown is equally as eligible a point for the termination of the rail-road, and is but two miles distant from the crossing of the North East river, on the road to the ferry at the Susquehanna. If the rail-road terminates at Simper's point, it must curve to the southward, and pass through the town of North East, at the distance of one and a half miles from the line direct to Charlestown; and if the termination be at Charlestown, the whole distance will be increased about three quarters of a mile. Both these positions are highly favourable for steamboat navigation, and for the construction of wharves, store-houses, &c. &c. This division is six and a quarter miles in length.

Upon a review of the whole line, it is highly satisfactory to find that it is laid nearly in a straight course, and that the several divisions which have been described, amount in distance to twenty-five and three quarter miles, counting from Market street, in the city of Wilmington, to Simper's point, at the head of the bay of North East. It is shorter than the post road, deducting the unavoidable increase of distance at the points of commencement and termination. One-third of the distance is level, and will require but little expense in execution. In the gradual approach to the table land, or summit, between the White Clay and the Elk, the grade is from fifteen to twenty-five feet in the mile, with but little cutting and embanking.

In passing the ridge between the Little Elk and North East, the ascending and descending grade is from twenty-five to thirty-five feet in the mile. The cutting at this ridge will be but forty-two feet, at its greatest point of elevation, while the shortness of the distance through it, together with the loose character of the soil, will render the excavation easy to execute, and at a moderate expense.

The soil, throughout the whole route, is uniformly composed of light loam, and a mixture of sand and gravel. Stratifications of white and red clay crop out on the summits of the ridges and table land. But few points of rock are touched by the line, and these occur only at Moody's, the crossing of the White Clay at Morrison's, and at the base of Chesnut hill. Detached boulders of horn-blende, hematitic ironstone, chalcedony, and jasper, lie scattered on the surface, and intermixed with the soil. Sand and clay form the whole surface of the country, from Elkton to the bay at Simper's point.

The principal bridges and embankments at the Red Clay, White Clay, and the two Elks, will constitute items of considerable cost in execution; these are unavoidable, and the expenditure ought to be liberally applied toward their substantial construction; particularly so, under the consideration of the smallness of the amount of labour in grading, fixing rails, and forming all other parts of the road, which you will perceive, upon reference to the detailed estimate accompanying this report, does not average more than \$19,000 per mile, for the whole distance from Wilmington to North East. The cost of the bridges, both large and small, including the culverts and drains, wharfing, and the fencing in of the whole route, amounts to \$169,485, making a total of \$507,623, to which is added three per cent., for contingent expenses and supervision.

In this estimate, an edge rail, similar to that used on the Liverpool and Manchester road, is contemplated, which is to be laid on white oak sleepers, and fixed in line, with half chairs on the inner and outer sides of the rails, omitting entirely the stone blocks and wooden string pieces, plated with flat bars of iron.

The whole distance from Philadelphia, by a rail-road route, passing through Wilmington and Elkton, to Charlestown, at the head of the bay of North East, is one mile less than the distance to Frenchtown, by the way of the river Delaware and Newcastle. At Charlestown, it is but six miles to the ferry on the Susquehanna, and five miles from thence to Port Deposit, by the river route; and whether *this route* be regarded as the great mail line, affording a speedy transit alike for passengers and goods to Baltimore, and for the conveyance of the products of the Susquehanna from Port Deposit, it is evidently the shortest and most direct that can be practically and efficiently established.

In conclusion, I must be permitted to express great satisfaction in the verification and close agreement of my present levels, with those which were made twelve years ago, in the survey of the northern route for the Chesapeake and Delaware Canal, a great part of which

route, you will perceive by the map, is now reported to you, as the most favourable ground for the contemplated rail-road.

Respectfully submitted, &c.

WILLIAM STRICKLAND,
Architect and Engineer.

Philadelphia, Feb. 10, 1835.

To Messrs. JOSHUA GILPIN, THOMAS GILPIN, JOHN CHEW THOMAS, JAMES CANBY, JAMES SEWELL, DAVID C. WILSON, WILLIAM CHANDLER, HENRY D. MILLER, GEORGE CRAIG, JOHN EVANS,	}	<i>Committee of Survey.</i>
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NOTES OF AN OBSERVER.

Remarks on Professor Olmsted's Theory of the Meteoric Phenomenon of November 12th, 1833, denominated Shooting Stars, with some Queries towards forming a just Theory. By JAMES P. ESPY.

(Concluded from p. 160.)

In connexion with this subject, I am glad to take the present opportunity of recording, and communicating to the public, the following most remarkable occurrence, communicated to me by Mr. Sears C. Walker, of Philadelphia.

Philadelphia, Dec. 8th, 1834.

DEAR SIR,—I send you enclosed the statements of Mr. Riggs, and Mr. Black, concerning the falling bodies seen on the evening of the 7th, and morning of the 8th, of August, 1833.

I should not have mentioned the occurrence of this phenomenon, but for the extraordinary interest on such subjects, excited by the meteors of November subsequent.

The weather during the day was precisely like that on the 12th of November, viz: rainy in the morning, and clearing up gradually from noon to sunset, but not entirely clear, with wind from westward till eight or nine o'clock in the evening. Going into an eastern room, at half-past eleven, to observe the immersion of *m Ceti*, I observed a great number of falling bodies in the field of view in the telescope; they cast a slight shade on the moon's disk, in falling, but were only partially opaque. Their appearance reminded me of that of phosphorus, slightly heated, so as to be visible, at night, when near. I thought that they were embers, or like the white ashes from burning pine, when blown suddenly, and listened to know if there was not a



MAP
(AND)
PROFILE
(Route) *OF THE*
Chesapeake and Susquehanna
RAILROAD.

Plans made under the personal direction of

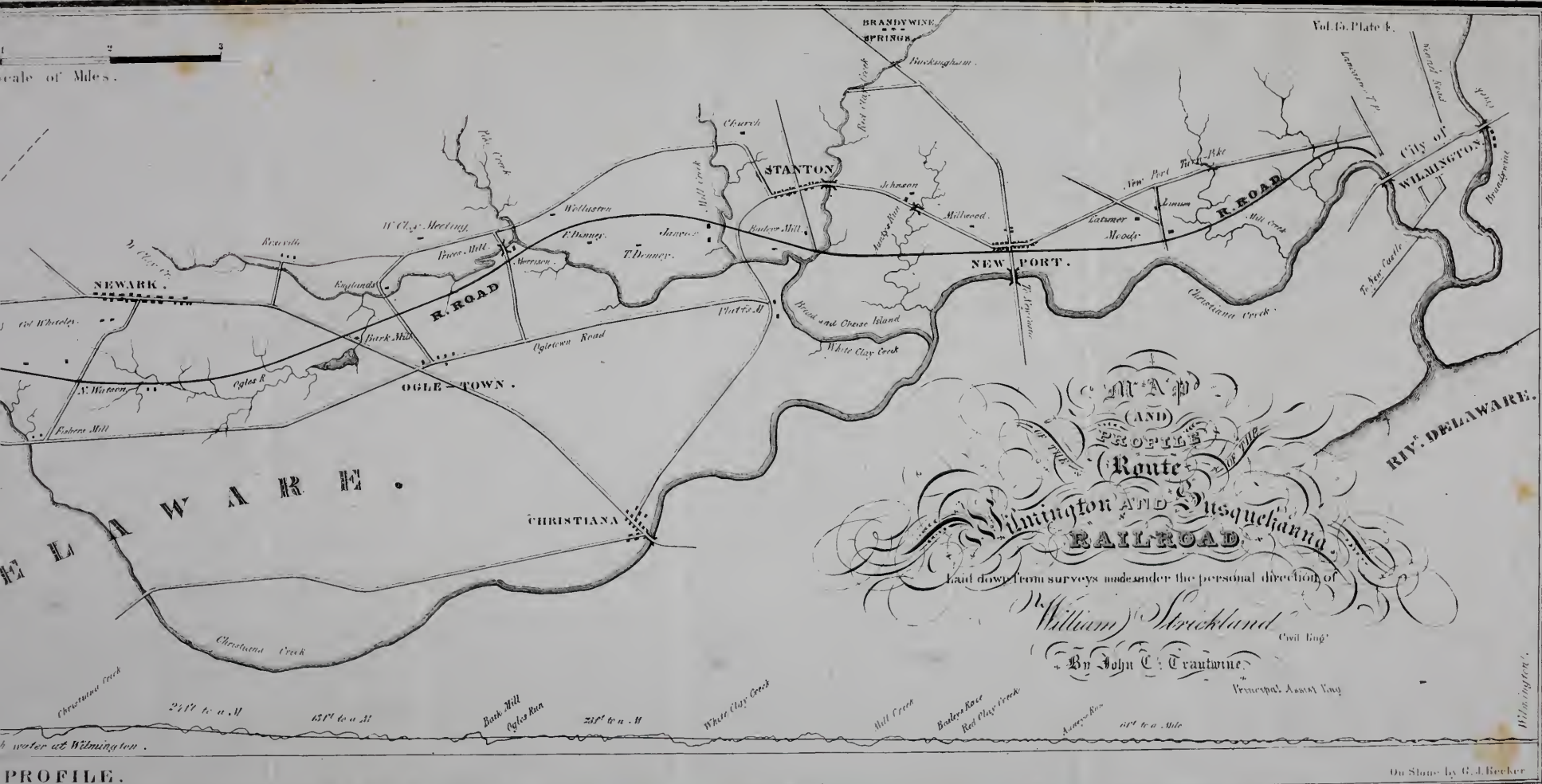
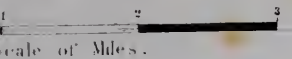
Wm. Strickland
Civil Eng^r

John C. Trautwine
Principal Assist. Eng^r

Scale
1/4" = 1 mile

Wilmington





fire from which they might proceed; but there was no alarm of fire, nor did I hear of any fire that occurred that evening.

I was not aware that they could be seen, except in the telescope, and supposed them at a great distance; and I should have continued of the same opinion, but for the fact that Mr. Black, who is employed to note time for Mr. Riggs, saw them on every side.

I have never seen any thing of the kind, before or since, in a telescope, and can only suggest that, possibly, they were meteors, which would have been more generally noticed, but for the moon's rays, which prevented their being readily seen, or attracting much attention.

I send this statement to you, as Chairman of the Committee on Meteorology.

Very respectfully,

Your ob't serv't,

S. C. WALKER.

JAMES P. ESPY, Esq.

I was observing the occultation of m Ceti, with a Dolland telescope, three and a half feet achromatic power, about thirty, on the top of house No. 100 South Eighth street. My attention was arrested by falling bodies, resembling snow; but reflecting that it was the warm season, (August,) I was convinced that they could not be snow. They seemed more like burned ashes, and fell mostly in a north-easterly direction. They seemed very light, and fell slowly, like flakes of snow, in a waving manner. I saw them, at occasional intervals, during fifteen minutes. We were unable to note the precise moment of the star's immersion, probably owing to our attention having been attracted by these falling bodies, (whatever they were.) The immersion was, however, noted precisely, to a second, by another person in the same premises, although out of my sight and hearing at that particular moment. We had a conversation on the singular, and, to us, at the time, extraordinary appearance of such things at such a time of night, (12 o'clock, P. M.) as it appears by our memorandum. The star is recollected by its diminutive size, being about the fifth magnitude, and more particularly so by my disappointment in not having noted the precise moment of its reappearance.

The occurrence took place on the 8th of August, 1833, as appears by the recorded observation of the star's immersion, but no note was made in writing by us at the time of the occurrence of the falling bodies, although frequently spoken of.

WM. H. C. RIGGS.

Philadelphia, Dec. 8th, 1834.

My impression was, that they were large flakes of snow, floating very lightly. I saw them plainly without a telescope, on all sides, falling quite thick. Mr. Riggs said there were birds before his glass, shortly after the immersion. I saw them falling near ten minutes;

I did not observe them longer, and do not know whether they continued longer or not.

JOHN BLACK.

By examining my meteorological journal, I find that the dew-point sunk 21° from the 7th to the 9th of August; on the 7th it was 73° , and on the 9th it was 52° , and on the night of the 8th there was a great rain.

Whether these were meteors or not, I will not attempt to say; the phenomenon is certainly worth recording; perhaps it may induce others to publish similar appearances, if any such have occurred. I may mention here, that in almost all cases of a sudden fall of the dew-point, it was succeeded by a fall of the temperature, and this too, *sometimes*, when the wind was coming from some southern point, as on the 31st of March, 1833, mentioned above. I find it difficult to conceive any cause adequate to the production of such an effect, but a downward vortex of considerable magnitude having taken place to the south-west of Philadelphia on that day, from the upper cold northern current, which was then actually blowing, as appeared from the clouds.

Who has not observed the wind increase in violence, on the approach of a cloud, particularly in the spring, when upper northern currents prevail? A vortex downwards would account for both the cloud and the wind. In such cases, I have more than once known the dew-point to sink three degrees in a few minutes, and rise again when the cloud had passed away. This latter effect was no doubt occasioned by the vapour of the surrounding air rushing, by its elasticity, into the cold, and comparatively dry, air of the vortex; or, if it should be found by experiment that the motion of vapour through air, from a high to a low dew-point, is too slow to produce the effect of condensation, perhaps the mingling of the air of the vortex with the surrounding air, may be considered sufficient.

Again, if meteors are formed, as here indicated, from an upper current, coming from some northern point, and containing less caloric to the pound than the air below, it will account for some remarkable circumstances known to exist, as will appear by consulting the various annual reports of the regents of the university, to the legislature of the state of New York, from '27 to '31, inclusive. First, a degree of cold sometimes occurs much greater in patches, or small areas, at no great distance from each other, than it is in the intervening spaces at the same time. For example, a severe frost, which killed vegetables, took place at Albany, Hamilton, and Ithica, on the 10th and 22d of May, 1830; at Cambridge, on the 9th, 10th and 23d; at Canandaigua, on the 9th and 21st; at Fredonia, on the 9th and 22d; at Canajoharie, on the 10th; at Cherry Valley, on the 10th and 23d; at Franklin, the thermometer was 24° , and the ice one-fourth of an inch thick, on the 26th—there was also frost on the 22d, at the same place; at Kinderhook and Lansingburg, on the 10th and 23d; at Lowville, on the 9th and 20th; at Middleburg, on the 8th and 24th; at Oxford, on the 22d; at Union Hall, on the 10th; at Washington, on the 13th;

and at Cazenovia, on the 22d. It is not a little remarkable, that on these same nights, nearly, the aurora was seen in the same insulated way, at some of the observatories in New York, and not at others. It was seen on May 9th, at Canajoharie and Hartwick; 10th, at Kinderhook; 11th, at St. Lawrence; 13th, at Delaware; 14th, at Canajoharie, Hartwick, Pompey, St. Lawrence, and Utica; 15th, at Delaware, Kinderhook, St. Lawrence, Union, Cazenovia, and very bright at Utica; 19th, at Fredonia; 22d, at Union.

The appearance of the aurora on these nights of great cold, in connexion with the insulated manner of its appearance, affords another link in the chain of evidence, that this meteor is low in the atmosphere, and also that it is probably connected with the sudden reduction of temperature which occurred about those times, at various places, in the same insulated manner.

It will be readily granted by the reader, that, if an upper current of air should overlap an under one at the surface of the earth, containing, under the same pressure, thirty or forty degrees of caloric less than the one below, the equilibrium would be unstable, and a vortex would as certainly be formed, in such case, as it would be in water, if it were evenly spread over oil, and nicely balanced, at the moment of the first agitation.

But he will very naturally inquire, how can such an upper current be formed, especially when it is known, both from theory and observation, that the uppermost strata of the atmosphere are in constant motion from the south-west, throughout the whole northern temperate zone. For answer to this question, I will refer him to a subsequent number of this journal, where, in my essay on hail, he will find that I have demonstrated that the quantity of caloric evolved by the condensation of vapour into rain, causes about five times as much expansion in the air containing the vapour, as condensation by the change of vapour to water.

From this fact alone, he will readily perceive that in all rains there is an expansion of air in the region of the cloud, and of course an upward motion, and that the velocity of this motion will be in proportion to the quantity of vapour condensed in a given time. From hence will follow an outward motion in the upper part of the cloud, and an inward motion in the lower part of the cloud; and this motion will continue as long as the rain, snow, or hail, and a little longer, from the nature of inertia.

Thus, if we have a great rain to the north, a current of air will be formed at the surface of the earth from the south, and an upper (not the uppermost) one from the north. This upper current, at first, may contain as much caloric to the pound as the air below, and perhaps more, from the great quantity of latent caloric given out by the condensation of the vapour it contained; but that part which overlaps, after the rain ceases, will be very cold, for a reason given in the first part of this paper. It is not a little remarkable that meteorologists have universally taken it for granted, that the whole effect of a rain is to produce a condensation of the air in the region of the cloud, when a moment's reflection would have shown them that every pound

of rain that falls, heats up 100 pounds of air forty degrees, or in that ratio, as more or less should be heated. For it is well known to them that a pound of steam is capable of heating one hundred pounds of water, when the steam is condensed in it ten degrees; and as the capacity of air for caloric is only about one-fourth that of water, it will heat up one hundred pounds of air four times as many degrees, nearly; and in case the vapour is turned into hail, or snow, a pound of it will heat up one hundred pounds of air, about forty-six degrees.

It will be readily seen, without a formal demonstration here, that the sudden rarefaction of the air, in some cases of rapid condensation, will be sufficient to cause a vortex upwards of very great velocity, sufficient to carry large drops of rain up to a height far above the region of perpetual congelation, and thus produce *hail*. But, as this *grand* principle has been fully explained in my "Essay on Hail," I only touch upon it here to illustrate the manner in which an upper current of air may be formed contrary to a lower one. This hypothesis of an overlapping current may be verified, or overturned, by ascertaining whether, or not, there was a great rain to the north-west of the United States, some days previous to the 13th of November, 1833.

Many other facts might be adduced, which strongly favour the conclusion that, in all cases of rain, or hail, or snow, there is an upward current of air in the region of the cloud, in consequence of the great rarefaction of the air, by the evolution of the latent caloric of the vapour, and of course an outward motion of the air at the upper part of the cloud, and an inward motion at the lower part, in many cases, where the dew-point is high, reaching down to the surface of the earth, and also that this upward motion of the air is the *cause* of these depositions; but it would be out of place to mention them here.

On the Influence of the Moon upon the Weather, from a Lecture before the Class of the Franklin Institute, delivered March, 1834. By G. EMERSON, M. D.

There is perhaps no opinion relative to the phenomena of the natural world, more universally maintained, than that the moon exerts a decided influence over the states of the weather. This long cherished notion has doubtless derived increased strength, since it was shown that the ocean tides depend upon a physical connection subsisting between our planet and her satellite.

I, however, think it capable of conclusive demonstration, that the moon exerts no influence in the production of wet or dry weather.

I assume it as incontrovertibly proved, by the experiments of Mr. Dalton, that the watery vapour from which rain, and all the precipitations, are formed, owes its elevation and suspension in an invisible form, entirely to heat, deprived of a due proportion of which by any refrigerating cause, it is condensed, and falls from the atmosphere in

one or other of the forms of aqueous precipitation. *The conditions of wet or dry weather are, consequently, to be regarded as regulated solely by temperature.*

Now, the nicest experiments have failed to show that the presence and light of the moon are attended by the slightest change of temperature. The lunar rays have been concentrated by powerful lenses, and the largest reflectors, and thrown upon that most delicate test of heat, the differential thermometer, without any indication of their effect in raising the temperature. Unless, therefore, it can be proved that the moon exerts some perceptible influence upon the temperature of our atmosphere, we shall be warranted in believing that she has no power in determining the conditions of the weather, whether this shall be wet or dry.

I am fully aware of the multitudes of observations which have from time to time been made upon this question, and that most of those reported appear to favour a belief contrary to the position here taken. Those collected by the celebrated Schubler, for example, made in several parts of Germany, during a series of no less than twenty years, and of Pilgram, of Vienna, embracing a much longer period, seem to have led the most intelligent men of the day into the unhesitating belief, that the quantity of rain bears a relation to the lunar phases.

Perhaps no one, at the present day, stands so deservedly high as a meteorologist, or has done so much to extend a knowledge of the agencies operating in the atmosphere, as Mr. Daniell, of London. His essays constitute a treasure, to one fond of tracing out the rationale of aerial phenomena, and especially of those connected with the atmosphere of vapour, as founded upon the principles of Dalton. But upon the subject of lunar influence in modifying atmospheric changes, he is confessedly obscure. That he does not reject the existence of such an influence, may be gathered from the following quotation:

“That the different phases of the moon have some connexion with changes in the atmosphere, is an opinion so universal and popular, as to be, on that account alone, entitled to attention. When to this result of universal observation, we add the philosophical reasons for the existence of tides in the aerial ocean, we cannot doubt that such a connexion exists. The subject is, however, involved in much obscurity. Mr. Howard is the only one who has treated it with the consideration it deserves.”

He then enters into an investigation relative to the action of the moon, as connected with the principle of gravity, and appears to have sedulously avoided even a speculation relative to lunar agency in modifying the common changes of the weather. For this prudential course, he deserves to be commended; an observation which we would also extend to Dr. Prout, who, in a recent popular treatise, embracing much matter in relation to meteorology, has entirely waived the subject of lunar influence upon the atmosphere.

In the most recent set of rules for observing the barometer as a

weather gauge, we have seen published, the opinion of lunar influence is recognized in the following terms:

"During the increase of the moon, there seems to be a greater disposition, or effort, in the air for clear dry weather, than in the wane; but this disposition does not usually commence till about three or four days after the new moon, and ceases about three or four days after the full moon."—*Walker*.

And even in a late inquiry, by M. Arago, in which so much evidence is furnished to disprove the agency of the moon in many of the phenomena usually ascribed to her, we find this distinguished philosopher admitting her influence upon the weather. Alluding to the multiplied observations that have been made upon the subject, he says: "Confining ourselves to the principal results, it seems difficult to resist the conclusion that the moon exercises an influence on our atmosphere; that, in virtue of this influence, rain falls more frequently towards the second octant, than at any other epoch of the lunar month; and lastly, that the chances of rain are fewest between the last quarter and the fourth octant."

But let us see whether it be not probable that even M. Arago has, on this point, fallen into the error he elsewhere condemns, of ascribing effects to wrong causes.

It cannot be denied that the power of the moon, so conspicuously manifested in the production of the ocean tides, may also be felt by the atmosphere. The aerial ocean must, weight for weight, be as subservient to the law of attraction subsisting between the earth and her satellite, as any other terrestrial matter; and I have no doubt of the correctness of the results of observations made in Italy and France, by Polina, Flaugergues, and others, which go to prove that the mean height of the barometer is affected by the different positions of the moon in relation to the earth, the greatest mean elevations corresponding with the quarters.* But, in thus admitting the existence of lunar influence upon the terrestrial atmosphere, we should not deceive ourselves in regard to the *nature* of this influence. We must not admit that every cause which operates in producing the rise or depression of the mercurial column, is capable of influencing

* The results of the calculations for the purpose of ascertaining the mean heights of the barometer, at the various lunar periods, are as follows:

Those made at Padua, by the Marquis Polina, extending over a period of forty-five years, were computed by Toaldo, who found that the mean height at the quarters was greater than that at the syzygies, by a difference of 0.46 millimetres.

Those of Flaugergues, made at Viviers, in France, and comprising a period of twenty years, gave the mean height at the quarters, 0.42 millimetres greater than at the syzygies.

Those made at the Royal Observatory, in Paris, and calculated by Bouvard, gave a difference of 0.69 on the same side.

The mean of these three estimates is $0.52\frac{1}{2}$ millimetres, as the height at the quarters over that at the syzygies; a small difference, indeed, but still one that is fairly appreciable. We regard the general agreement such as to render the minute differences in the respective results a matter of minor importance, and not sufficient to invalidate, but rather to confirm, the evidence.

the hygrometric conditions of the air, or, in other words, exercising an influence in the production of wet or dry weather. The attraction subsisting between the earth and moon, causes an accumulation of the liquid and movable materials spread over the terrestrial surface, on that part addressed, towards the moon. Hence the rise observed in the sea, and in the mercurial column. But all this is owing to the agency of *gravity*, or *attraction*, which, we contend, has nothing to do with the production of wet or dry weather, the elevation and deposition of aqueous vapour being, as we have said before, subject to the agency of temperature alone.

As to the calculations, the results of which, even with such investigators as Arago and Daniel, seem so irresistibly in favour of lunar influence upon the weather, we think it easy to show that they must be founded upon deceptive data, and will not bear a close examination. The estimates of Toaldo, a celebrated Italian philosopher, embrace a series of laborious observations, collected during many years, and compute the number of *changes* of weather to the different phases of the moon, as follows:

New Moon,	6 to 1;
Full Moon,	5 to 1;
First Quarter,	2 to 1;
Second Quarter,	2 to 1;
Perigee,	5 to 1;
Apogee,	4 to 1.

That is to say, of seven new moons, six were attended with a change of weather, and at one of them there was no change; of six full moons, five were attended with a change; and at the quarters, the changes were twice as frequent as the continuance of the previous weather.

Now, such a computation, coming from so high an authority, might almost be deemed conclusive upon the subject. When, however, we come to inquire more closely into the circumstances involved in the calculation, we find ample grounds for suspecting its accuracy. In the first place, the term "*change of weather*" is used by Toaldo in an ambiguous and arbitrary sense, so that we are left ignorant of the specific change he refers to. But worse than this, he does not restrict himself to the day when the change takes place, but includes any changes within two or three days preceding or following a phase. It is easy to conceive how a person, especially one prepossessed in favour of a prevailing opinion, might have been led, with such a privilege, as to limits, to take or reject a change, to throw it into one quarter or another, as he might choose to dispose of it, for the purpose of endowing the moon with a power to which he thought her entitled.

The results of a series of observations made by Pilgram, make it appear that the new moon has less to do with the changes of the weather than the other phases; a conclusion diametrically opposed to that of Toaldo, just referred to. As the estimate of Pilgram is founded on observations extending through a series of no less than fifty-two years, it might be regarded, in point of authority, as at least equal to that of the Italian philosopher. How are these clashing

results of observations, professing to be made with the utmost attention, to be reconciled with truth? Do they not leave us to infer that the data employed have been either deceptive, unskilfully grouped, or that some incidental or accidental circumstances have interfered with the estimates, and led to erroneous conclusions?

The belief in the moon's influence over the natural operations going forward upon our earth, has by no means been confined to the weather; and it would be a tedious task to enumerate all the agencies she has been allowed to possess over organic and vegetable life, both animate and inanimate. "Many of the opinions vulgarly entertained upon this head," says M. Arago, "are founded on well established facts, the error lying, not in the observations, but in the theory which makes the moon the *cause* of phenomena, of which she is only the silent and unconcerned spectator." The distinguished philosopher from whom we have just quoted, has cited a number of highly interesting cases, which show in the clearest manner how the effects that have been ascribed to the moon's influence, can be readily traced to natural agencies, operating around us, and with which modern philosophy has rendered us familiar. Such, for example, as the pernicious influence upon vegetation, attributed, by gardeners and agriculturists, to the April moon, the effect of the moon's rays in hastening the putrefaction of animal substances, &c.; all of which effects are doubtless connected with the presence of moonlight, merely, however, as an incidental circumstance, for they would take place equally well in a clear atmosphere, even should there be no such body as the moon in existence.

Let us take, for example, the case of the April moon, denominated, by the French gardeners, "*la lune rousse*." The *change* in this case takes place in April, and the *full* either about the end of this month, or some time in May; at which particular season, in our climate, the mean temperature of the air is but little above the freezing point. Under these circumstances, the radiation from the earth, during a clear night, will often reduce its temperature to, or even below, the freezing point; whilst a thermometer suspended in the air, a few feet from the ground, will remain several degrees above 32°. Thus, the tender plants in the soil may become actually frost-bitten, whilst the atmosphere has been apparently too warm to admit of such an occurrence. If, on the contrary, the night be cloudy, the plants will suffer no injury, not, as the gardeners allege, because there is no moonlight to hurt them, but because the radiation and cooling of the earth will not take place. Thus, moonlight or starlight, the injury to vegetation will be precisely the same, and the effect might as well be ascribed to the stars as to the moon.

And again, it has been noticed by Pliny and Plutarch, and is generally believed in most countries, at the present day, that the moon's light sheds a copious humidity on substances exposed to its rays, and hastens the putrefaction of animal substances. That a copious humidity is often shed during a moonlight night, is not to be disputed; neither can it be doubted that meats will spoil sooner, if exposed to her rays, than if protected from them. The nature and source of

this humidity can be no mysteries, now that the rationale of the formation of dew is so happily explained; and it is sufficient to say, that the moisture deposited upon the meat, causes it to spoil much sooner than if kept covered, when it would remain dry. Meats are constantly preserved by simple drying, and even the mummies in the dry caverns of Egypt have lasted thousands of years, mainly from their depositories being perfectly free from moisture. The preserving agency of embalming is, perhaps, a secondary consideration, when compared with the subsequent state of dryness in which the bodies are kept.

As to the notion of lunar influence on disease, which still counts numerous partisans, and upon the existence of which a book has lately been published in England, we regard it, notwithstanding the authorities of Galen, among the ancients, and Mead, Hoffman, and others, among the moderns, as upon precisely the same footing as the exploded doctrine of the agency of the stars, so long and stoutly maintained.

Upon the whole, therefore, I look upon it as clearly demonstrable, upon established philosophical principles,—

1st. That wet and dry weather, with all the influences concerned in the deposition or suspension of vapour, are matters regulated solely by changes of temperature, over which the moon has no control.

2dly. That most, if not all, the effects upon animal and vegetable substances, popularly ascribed to the action of the moon, are to be traced to natural agencies, entirely independent of this satellite.

FRANKLIN INSTITUTE.

Monthly Conversation Meeting.

The fourth conversation meeting of the Institute, for the season, was held at their Hall, Jan. 22d, 1835.

Mr. S. V. Merrick exhibited a gas meter, which had been brought by him from England, for the examination of the City Councils. The front of the revolving cylinder being of glass, permitted a view of the interior of the apparatus, the compartments of which, with the entrances and exit openings, were characteristically coloured.

Messrs. B. Slater & Co. deposited for examination, a machine for shearing cassimeres, invented by Mr. Samuel Parsons, of Hosick Falls, New York, combining some parts which are considered as improvements, and the work done by which is highly commended.

Mr. Titian R. Peale presented specimens of his method of securing specimens of butterflies from the depredations of insects; he stated that a splendid collection of this kind, which had existed in Paris in the year 1812, had been, within the interval of ten years, entirely destroyed. The specimens are attached by small bits of cork to panes of glass, made perfectly clean, and which form the transparent sides of boxes intended for the exhibition and preservation of the specimens; the insects which prey upon the specimens,

not being able to move upon the perpendicular panes, are not able to pass from one specimen to another; and if even their eggs should have retained vitality under the preliminary operations of baking at the heat of boiling water, their destructive action is confined to a single specimen.

Mr. George P. Schively deposited for examination, a cancel hammer, which was stated to have been the work of an apprentice of less than one year's standing, and which was very much admired for the style and finish of the workmanship. He also deposited a pair of skates, which were much approved of for their correct shape and finish.

Mr. Rufus Tyler exhibited the shifting gauge for steam boilers, for which the award of a premium from the Scott's legacy had been recommended by the Committee on Science and the Arts, to the inventor, Mr. Philos Tyler. A report upon this, by the committee, will be found on page 178 of this Journal.

Prof. A. D. Bache showed the experiments relating to the production of a spark from a single galvanic circle, by interposing a long conductor between the poles, and stated the explanation given by Prof. Henry, to whom the discovery of the facts was due. A notice of these several points will be found in the March number of this Journal.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. M. W. Baldwin's Locomotive Engines.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination certain improvements in Locomotive Engines, made by Mr. Matthias W. Baldwin, of the city of Philadelphia, REPORT:—

That they have examined several of these engines, which are now being built in Mr. Baldwin's workshop, and find in them numerous improvements, affecting nearly every part of the machine. The first they will notice, are in the position and construction of the force pumps, which supply water to the boiler; the guides of the piston rods are made hollow, and the cavities are used for the chambers of the force pumps, thus giving additional strength to the guides, without much increasing their weight, and dispensing entirely with the frame and fixtures of the ordinary force pumps. Each of these pumps is furnished with five valves, three of which are situated between the boiler and the piston, and two between the piston and water tank. The valve nearest the boiler is loosely swivelled to a stem, passing through a steam-tight collar in the top of the valve box, by means of which the valve can be sounded, and, in most cases, freed from obstructions.

The other four valves are contained in one box; this box is secured to the pump by a stirrup, which can be removed by loosening a single screw, so that the valves can be taken out, cleansed, and replaced, in a few minutes. By thus increasing the facility of ex-

aming and cleansing the valves, and thereby diminishing the liability of the force pumps to obstruction, the supply of water to the boiler will be rendered much more regular and certain; and the chief cause of those fearful explosions incident to steam engine boilers, will be in a great measure removed, as it is confidently believed that these accidents are generally the result of a deficiency in the supply of water.

Another improvement consists in the manner of reversing the motion of the steam valves. This is done in the English engines by means of a treadle, and a series of levers, which move the eccentrics laterally on the propelling axle, after the hooks of the eccentric rods are thrown out of gear with the rock-shafts. In Mr. Baldwin's engines, the arms of the rock-shafts extend on opposite sides of the fulcrum, and each eccentric rod is furnished with two hooks, turned in opposite directions, so that it may be geared to either arm of its rock-shaft; the eccentrics are fixed immovably upon the axle, and the eccentric rods, instead of being carried (as they usually are) to the front of the engine, are brought to the stage at the hinder part, and there geared to either arm of the rock-shafts, at the option of the engineer. When the hooks of the eccentric rods are geared to the same arms of the rock-shafts as the valve rods are, the motion of the valves corresponds to that of the eccentrics; if they be geared to the opposite arms, the motion of the valves will be reversed; and if they be not geared to either arm, the rock-shafts and steam valves can be worked by the hand levers. The advantages of this arrangement are several; the eccentrics being firmly secured to the axle, are less liable to get loose, and out of repair; it dispenses entirely with the treadle, and its appendages, and also with four rock-shafts, and the complicated hand gear of the English method.

But the most important benefit is, that the rock-shafts and eccentric hooks are placed immediately under the eye, and within the reach of, the engineer, which is not the case in the ordinary arrangement.

The axle of the driving wheels has also been made the subject of improvement by Mr. Baldwin. Instead of fixing the ends of the axle into the centres of the wheels, as is usually done, he dispenses with one of the arms in each crank, and fixes the wheel upon the wrist of the crank, with its centre adjusted to the centre of the axle. By this change in the form of the axle, the power of the engine is applied directly to the wheel, without the intervention of an arm of the crank, thus diminishing the strain upon the axle, and, consequently, lessening its liability to be broken. By this means, also, Mr. Baldwin has, in some measure, obviated the tendency of the driving wheels to twist upon the axles, and become loose; a very general and troublesome defect of locomotives. Another good effect resulting from this change, is, that the distance between the two cranks is increased about ten inches, which will admit of a corresponding enlargement of the boiler, and of a more advantageous disposition of the weight of the fireplace, by bringing it about fourteen inches nearer to the axle. In these engines, the steam pipe is intro-

duced into the boiler through the opening by which it usually communicates between the dome and the cylinders; and the end of the pipe beneath the dome is supported on a horse, fixed within the boiler, so as to admit of its longitudinal expansion and contraction by changes of temperature; and to avoid inconvenience from the same cause, the stop of the throttle valve is fixed on the steam pipe, instead of the head of the boiler. A twofold benefit is derived from this plan of introducing the steam pipe; first, the pipe may be made without a joint within the boiler; and secondly, a man hole in the boiler may be dispensed with; for the juncture between the dome and boiler, as well as all the other steam joints, being accurately fitted by grinding, and formed without any cement, or packing, the dome can easily be taken off and replaced, and its aperture used for occasional access to the inside of the boiler.

In the construction of his driving wheels, Mr. Baldwin uses hubs and spokes of iron, cast in one piece; felloes of hard wood are framed into the ends of the spokes, and the whole is firmly bound together by a stout tire of wrought iron, with a flanch on its inner edge; thus, by a judicious combination of iron and wood, he has united the strength and firmness of the former, with the elasticity of the latter, so desirable in the tread of the wheels.

Mr. Baldwin has completed several engines, which combine all these improvements; one of them may be seen in operation on the Philadelphia and Trenton Rail-road, and four on the state road to Columbia; all of which, as well as one in use at Charleston, South Carolina, have given entire satisfaction by their performance.

The committee are informed that some of these improvements have been secured to their inventor by patents; and that he richly deserves to reap the benefit of them, will be admitted by any one who is aware of the present extensive use and increasing demand for these costly structures.

By order of the committee.

WILLIAM HAMILTON, *Actuary.*

February 12th, 1835.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN SEPTEMBER, 1834.

With Remarks and Exemplifications, by the Editor.

1. For a *Perpetual Shoe Bench*; Samuel Haynes, Malden, Middlesex county, Massachusetts, September 1.

A long bench is to be made, which may be about three feet high; and from a platform on the floor, a row of standards, or uprights, are to extend up, through this bench, projecting above it to a sufficient height to receive the last in a notch, made for that purpose, on its upper end. These standards are to be about a foot apart, and for one workman there may be ten, or more, of them. Straps are to extend from the lasts, through holes in the bench, their lower ends

being attached to treadles near the floor; then, by placing the foot upon a treadle, the strap is strained so as to hold the last firmly down, and by slipping the treadle under a cleat, it becomes fixed. Shoes or boots which are to be wrought upon, are placed on the lasts, and all of them confined in the same position, each in its own standard; this is to enable the workman to pass from one to the other, alternately performing the same operation upon each, and thus avoiding the necessity of a frequent change of tools and position. The patentee says that, "in this mode, the operator will be able, in a given time, to manufacture and finish, in a complete, thorough, and workmanlike manner, more than double the number of shoes that he could in the usual mode of manufacturing."

"Some parts of the machinery herein represented and described, have been heretofore known and used;—I believe some parts of it are new; but not being sure of this, I claim no part of the machinery as constituting my invention; but my invention, which I hereby claim, and for the exclusive right of which I now desire letters patent, is, *a combination of machinery to produce a new and useful result.*"

Although there certainly is no great portion of invention in this contrivance, we think that there is sufficient novelty in it to sustain a patent, which will be very valuable, if its utility is equal to, or approaches in amount, that stated by the patentee.

2. For an improvement in navigation, called the *Cylinder Boat*; Amos Kendall, city of Washington, District of Columbia, September 2.

The basis of this boat, or that part which touches the water, is to consist of two, or more, hollow, water-tight cylinders, stretching across, and under, it; which cylinders are to be of such dimensions as may be required by the size of the boat. They are to be covered, or surrounded, by paddles, or floats, extending from end to end, but divided into sections, so arranged that no two of them shall strike the water at the same instant.

The body of the boat is to rest upon two side timbers, on the under surface of which the gudgeons of the cylinders are to revolve in suitable boxes, or upon friction rollers. Motion is to be communicated to the cylinders by means of cranks, chain wheels, or other gearing. The cylinders may be divided into two sections, with the cranks, or chain wheels, in the centre; or if continuous, the power must be applied at one of their ends.

The grand result of a vessel thus constructed, is, that its whole weight rests entirely upon the axes of the cylinders, these cylinders taking the place of both the hull and paddle wheels in ordinary boats, the progressive motion being obtained by the rolling of the cylinders within the water; "the advantage expected, is greater speed with light loads than is attainable in the present mode of navigation." "The improvement claimed, is the use of revolving cylinders, with paddles in sections on the outer surface, to supersede the hull and

paddle wheels, (or other machinery for the same purpose,) 'of the common boat.'"

On the 23d of April, 1834, a patent was obtained by Mr. Anthony Plantou, for a new mode of constructing and propelling steamboats, &c., which is noticed at p. 334 of the last volume; that gentleman proposes to employ similar hollow air-tight cylinders, with floats, or buckets, in conjunction with hollow buoyant trunks, which, in combination with the cylinders, are to sustain the load.

When it is recollected that but a small portion of a paddle wheel can be allowed to dip into the water, it does not appear that cylinders, such as are described, can be employed, without making them of a diameter which shall mount the boat high in air. Such cylinders, we believe, would sink as deep as is allowable, by their own weight alone; and even with the addition of the hollow trunk proposed by Mr. Plantou, we do not believe that this objection would be entirely removed. "Paddles in sections" have been patented by the Messrs. Stevens, of New Jersey, and, we presume, have been so claimed by them, as not to admit of their use by others.

3. For a *Thrashing Machine*; Israel Lukens, Upper Dublin, Montgomery county, Pennsylvania, September 2.

This is the usual cylinder and concave machine, upon each of which parts smooth iron bars are to extend from end to end, the cylinder being borne up against the concave by means of springs, thus causing the grain to be rubbed between them by the revolution of the cylinder. Spikes are also set upon the latter, to draw in the straw, and keep it straight.

A smaller cylinder, also furnished with iron bars, revolves close to the periphery of the larger, but with a slow motion, being driven by a cog-wheel on the main cylinder shaft, gearing into one of three times its size on its own shaft; upon this rests a second small cylinder, or roller, which is borne down upon it by springs, and receives its revolution from the action of the iron bars of that upon which it rests. "These cast wheels, rollers, and springs, are also claimed as part of the invention," which is all that is said about the claim, leaving us at a loss respecting what else is considered as making a part of the invention, which is unfortunate, as, in it, there is much of antiquity accompanying whatever there may be of novelty.

4. For an improvement in the application of steam to the purpose of cooking, called the *Steam Baker*; Charles F. Wilcox, Springfield, Hampden county, Massachusetts, September 3.

A steam boiler is to be made by taking two cylinders of iron, one smaller than the other, placing them concentrically, and uniting them by a rim at top and bottom. The space between these cylinders is to contain the water, and the interior cylinder forms a part of the body of the furnace. "The space between the two cylinders, for the generating of steam, must be adapted to the size of the apparatus. In one eleven inches in diameter, and seven inches deep, the space

may be one inch wide." In an aperture near the top, a tube is inserted to supply water. The boiler is to be placed on a stand, forming an ash pit, with grate bars to support the fuel. On the top of the boiler there is to be a cast-iron dish, or skillet-like vessel, and this is to be furnished with a tin cover, forming, with the dish, an oven, or cooking chamber. On one side of the boiler, at its upper edge, a brass cock is to be inserted, and a tin tube, with suitable joints and elbows, is to conduct the steam from this cock into the oven, or cooking chamber, an opening being left in the tin cover for that purpose.

"The improvement consists in the mode of conveying the steam, and in connecting the steam with the heat from the furnace, in one operation."

This may really be an improvement in the mode of cooking, but we confess that there appears to us to be more of contrivance than of utility about it; we are much mistaken, therefore, if it is destined to find favour with the kitchen comptrollers.

5. For machinery for *Cutting Crackers*; Lucius Kirtland, New Haven, New Haven county, Connecticut, September 4.

This machine, as the title indicates, is employed only for the *cutting* of crackers, as no mention is made of rollers for rolling the dough to a proper thickness, in the manner of most of the machines previously patented. A frame is made, by taking two planks to form the cheeks, which may be about ten inches wide, and extend from the floor to the ceiling, at the distance of about seventeen inches apart. A cutting board is framed into these, at the height of about three feet from the floor, the surface of which board is to be covered with sheet lead. The cutters are made of tin, and are fixed on to the lower side of a board, which, with the other parts of the machinery, slides up and down between the cheeks. A machine of this size may contain twenty-eight cutters.

Within the cutters there is a piston, called a cracker discharger, consisting of a rim of block tin, with three arms, uniting it to its centre, into which a rod is fixed, extending up vertically; and between the arms of this discharger, docking wires are placed. Similar pistons are employed to force out the scraps of waste dough from between the cutters. The cutting board, the cutters, and the carriage to which they are appended, are brought down by means of a treadle, and raised by a weight at the upper part of the machine, connected with the carriage by ropes passing over pulleys. The dough is to be placed on the cutting board by the aid of a paddle, or shovel; the cutters are then brought down by means of the treadle, and the crackers are consequently cut and docked; on allowing the carriage to rise to a certain height, the cracker dischargers operate, and push out the crackers on to a paddle, placed under to receive them; they are then ready for the oven; on the rising of the carriage a little higher, the scrap dischargers push out the waste dough from between

the cutters, which is removed from the board by passing in the next paddle with dough.

The inventor does not claim "the cracker cutters, and cracker dischargers, as heretofore used and worked by hand; but claims the scrap dischargers as wholly new, and the cracker dischargers as above described, and operating by machinery; and also the combined machinery as above specified, by which the crackers are cut and pricked, and the crackers and scraps separately discharged by its operation."

6. For an improved press, for *Pressing Cheese*; Elijah Barnes, North Brookfield, Worcester county, Massachusetts, September 5.

A single screw is to force down a follower, upon the cheese, within its hoop, and placed upon a suitable bed. One advantage of this press, we are informed, is, that if the frame and bench be made long enough, and there be a sufficient number of screws, any number of cheeses may be pressed at the same time; a piece of information, most assuredly, of the utmost importance. We are told, also, that "The screw presses are considered preferable, by experienced dairy people, to those with the pulley, or lever, because they are liable to press too hard at first, and, consequently, force out the whole whey, or goodness of the cheese." Were we fond of notes of admiration, we certainly should place a few at the end of these quotations; we know of no other novelty in the affair than is to be found in the opinions of the patentee, who has left us to guess at what he ought to have claimed; we, however, refer this question to "experienced dairy people."

7. For a machine for *Hulling Barley*; Henry Handschey, Bridgeville, Muskingum county, Ohio, September 5.

A frame is to be made, to contain a row of stampers, which slide in mortises made in horizontal pieces, attached to the frame. Below the stampers, in the sill of the frame, there are excavations forming mortars to receive the barley. The stampers are to be raised by wipers, projecting from a revolving axle, which catch against pins. This constitutes the whole of the machine, in which there is about as much novelty as there is in a common rolling pin, or a clothes horse.

8. For *Wheels for Carriages, &c.*; Barney Ruggles, Warsaw, Genesee county, New York, September 8.

A wrought iron rim, and an iron hub, are to be connected together by spokes formed of spring steel, bent into a curve. These spokes are to be attached to the rim, and to the hub, by screws, rivets, or otherwise. This is all the information given upon the subject of the invention. Wheels similar to these were made about two years since, and attached to a fire engine, by the late Joel Eastman, who expected that they would, by their elasticity, operate

as springs, and afford some relief in the motion of that apparatus; they are, we believe, still in Georgetown, D. C., where Mr. Eastman died.

9. For a *Shoe for Mill Cans*; James Dennis, Providence, Rhode Island, September 8.

The mill-can-shoe is a ring of either cast or wrought iron, and is intended to protect from injury the bottoms of the cans, and the floors on which they are used. This ring is furnished with a flanch, or projecting ears, by which to attach it to the can. The patentee "claims the shoeing mill cans with cast or wrought iron, or other metal, and the form of the shoe above described." As respects form, it is said that the ring may be half an inch, or more, in width, and that it may be "concave, convex, or convexo-plane." Mr. Butterworth, of Philadelphia, obtained a patent for a similar contrivance, some years since.

10. For a *Circular Saw Mill*; John Penman, Charlotte, Muhlenburg county, North Carolina, September 9.

After describing the frame-work, carriage, and mode of gearing, in this mill, the patentee claims one part only of the whole, and in this, unfortunately, he has long since been anticipated. He says, "My claim consists in the application of two circular saws, one above, the other below, operating in the same plane." Saws so placed have long been in use in England.

11. For *Lessening Friction, by friction rollers*; Isaac Clowes, Norfolk, Norfolk county, Virginia, September 9.

It has, more than once, happened that contrivances for lessening friction, have actually produced the reverse effect; and should the plan now proposed be carried into operation in "steamboats, grist mills, carriages," &c., another example of such an effect will be added to the existing list. In the principle upon which the present patentee depends, there is not any thing of novelty, as it consists merely in the revolution of the axle of one wheel upon the periphery of another; and whatever there may be of novelty in the arrangement, or rather in the complication of the parts as contrived by the inventor, will not be accompanied by any portion of the utility he anticipates. He informs us that there are to be eight, or more, frames made of metal, to contain the rollers which are to be employed; that seventeen large friction rollers are to be sustained between four of the frames, and that there are to be seven movable metal boxes to each frame, in which fourteen of the friction rollers play, surrounded by small friction rollers in each box; and much more to the same effect. The claim is to "the preventing the axles, or gudgeons, from wear, by applying composition or metal boxes of any kind, stationary or otherwise, around them; and the method of applying the large friction rollers, with the frames and movable boxes, and with or without the small friction rollers under the gudge-

eons of the large friction rollers, which are not immediately under the axles of cars, or gudgeons, &c., as usual, or heretofore applied, preventing both friction and wear." If the patentee can discover some materials which are perfectly hard, and perfectly inflexible, and a workman who can give to such articles a finish perfectly smooth, and perfectly true, he may derive some advantage from his contrivance; should he not do this, he will find that when he gets one of his complex friction boxes into actual operation, not one-half of the rollers will turn round when there is any load upon them, and that, after a little while, his circles will be converted into polygons.

12. For improvements in *Locomotive Engines, and Cars for Rail-roads*; Matthias W. Baldwin, Engineer, Philadelphia, September 10.

This patent is obtained for several improvements, which are claimed in the following words:

"What I claim as my improvement in the respective parts of locomotive engines and cars, herein described, is, first, the manner of constructing the crank, and inserting the wrist thereof, prolonged, into a socket in the wheel, or otherwise attaching it thereto, for the purpose of obtaining the advantages set forth. Secondly, the casting the wheel with the arms, or spokes, separate from each other, and attaching them to a rim, or felloes, of wood, by separate flanches. Thirdly, the manner of constructing the pump chamber, so as to fit it together without any packing, and to confine the respective parts in their places by means of a stirrup, operating in the manner described; and also, the forming the chamber of the pump itself within one of the guide pieces. Fourthly, the general manner of constructing and adapting the junctures of steam, or other, tubes, without packing, as set forth; not intending, however, in either of the cases referred to, to confine myself to the precise form and construction represented in the drawings, but to vary the same in any way by which I may be able to attain the same ends by analogous means."

13. For a *Brick Machine*; Cyrus Chaney, North Prospect, Waldo county, Maine, September 11.

This machine for mixing clay and moulding bricks, differs but little, either in principle or arrangement, from some others in the patent office. The claim made is to "The combination and arrangement of the several parts of the machine."

The clay is to be mixed by the turning of a vertical shaft in a cylindrical box, knives projecting from the shaft and the sides of the box in the ordinary way. The mixed clay passes out through an opening at the lower end of the box, on one of its sides, where it is received into another box, whence it is forced down, by means of a follower, into moulds placed upon a carriage, admitting of their being easily changed. Those who have paid attention to the various machines patented for this purpose, will perceive that this general description does not include any thing of novelty; under these circum-

stances, it was incumbent on the patentee to designate the particular points in which his machine differs from others; the law absolutely requires that this should be done, and without it, there can be no such thing as an infringement of his patent.

14. For a *Stove*; James Wilson, city of New York, September 12.

The petition alleges that this patent is taken for "an improvement in the construction of the union, or double, grate, connected with stoves of various forms and kinds, for the burning of anthracite or bituminous coal, for heating rooms in all their varieties and forms, and for all culinary purposes; with an entirely new constructed feeder, or hopper, adapted to all the varieties of stoves and furnaces."

The specification, as may be imagined from the foregoing announcement, is one of considerable length, referring not only to ordinary stoves for warming, and cooking, but also to cupola, and other furnaces; but this is done without an adequate acquaintance with the structures spoken of, and without the application of any common principle to each of them, which could legitimately bring them within the compass of a single patent. The claims alone occupy more space than we think proper to afford to this article, and we will, therefore, offer an epitome only, of them.

They are made to the guarding the ovens of all cooking stoves from burning at bottom, by a second plate, placed under them. To a mode of directing the fire to the boiler, and to the upright parts of the oven plates. A sliding guard plate, connected with a sheet iron, or other flue for tinning sheets of copper, and thereby regulating the action of the fire. The construction and mode of fixing a sliding or revolving damper. The saving from breaking all stoves or cast iron plates, by curving the same at least the thickness of the plates. These claims, with much other matter, relevant and irrelevant, apply to the cooking stoves, which, though last in the specification, we have accidentally taken up first.

The union grate, as described, is claimed; also the manner of discharging the same by means of a swing, or drop gate, describing the quarter, or any segment, of a circle, &c. &c. The opening of the sides of the stove, for the admission of air. A movable damper, or valve, sliding under ovens.—Cast iron guard plates, separate from the sides or back of the stove.—An upper damper. After this comes the feeding of furnaces, and some other matters, about which we are convinced that our readers will not wish to hear; we therefore dismiss the subject.

15. For an improvement in the *Horse Collar Block*; Dyer Cleaveland, Owego, Tioga county, New York, September 13.

A block is to be made in the usual form of those used by collar makers, and this, it is stated, may be either of wood, or of cast iron. The collar, with a rope passed round it in the ordinary way, is to be placed upon the block, and, by means of a screw, a slide, is made to

work horizontally in a groove along the middle of the block, is to be forced against the rope at that part of it which passes round the small end of the collar; after the collar has been properly shaped by the force of the screw, its two ends are to be sewed together, and again placed upon the block, that the slide may be forced against it a second time, to give it a final shaping.

On turning to No. 40, for the last month, p. 108, it will be seen that three patents have been obtained, within three months, for what is essentially the same thing; in the plan described in the specification before us, the rope is pushed, instead of being drawn, by a screw; but this is only a colourable difference, which any common mechanic might devise, without possessing the least talent for invention. From the circumstance of the entire similarity of the inventions, as well as from the residence of each of the patentees in the same state, and in counties not very remote from each other, the conviction that they are not all "true and original inventors," is irresistibly forced upon us.

16. For a *Relief Bedstead*, for the use of invalids; David Anthony, Adams, Berkshire county, Massachusetts, September 13.

The bedstead described in this specification is furnished with most of the conveniences proposed in those which we have had occasion to notice, or which are described in the books. There is some variation in the manner of raising and lowering the different parts, but nothing essentially new. The patentee claims nothing more than the operating upon the various shifting parts in the manner described by him, and more than this he certainly could not sustain.

17. For a new *Material for Stuffing Mattresses*; Elias Howe, Cambridge, Middlesex county, Massachusetts, September 13.

The material to be employed is palm leaf, which is to be separated into fibres by hatchelling, or otherwise; these fibres are then to be employed in the manner of horse hair, or corn husks, for filling mattresses. We are not aware of any superiority which the palm leaf possesses over the corn husk, which is a very good material, and one largely used for the purpose. It is not improbable that in the country of palms, some of the inhabitants have been in the practice of making their beds of these leaves, in which case the patent here would not be good, as the patentee has to sustain his claim against the whole world, and all time.

18. For an improvement in the construction of *Water Cisterns*; Obadiah Parker, Syracuse, Onondaga county, New York, September 15.

This patent is taken for an improvement on the manner of constructing cisterns, for which a patent was obtained by Samuel Booth, of Syracuse, on the 20th of August, 1833, which patent, with some others for that year, was omitted in our list, in consequence of an

oversight in the patent office. We shall take an early opportunity of supplying this deficiency.

The present patentee says that instead of taking rough planks, and forming the cistern with these, and then plastering over them with the cement, he digs a hole, or pit, about a foot greater in diameter than the intended cistern, and prepares circular moulds, or drums, of the intended diameter of the cistern, and about two feet wide, one of which he places upon the bottom of the pit, and then plasters round it with hydraulic cement, to the thickness of three inches, carefully ramming in earth, all around, between the cement and the original ground, as the work proceeds. A second mould is then put upon the first, and secured to it by hooks and staples, and the operation continued until the desired height is attained, when the sections of moulds are removed. A floor is then formed of the same cement, mixed with gravel, or with stone, if preferred. Other moulds, adapted to the purpose, are employed upon which to form an arched top, from the same materials.

The improvement claimed "consists in forming and making the cistern of hydraulic cement, without having any wood, or perishable matter, left in or about it, and in the manner above specified, by means of moulds for the body and top, thereby making a more firm and perfect cistern, it being a complete cement jar; also, in making it above ground, and, as an improvement on said Booth's patent, claiming nothing therein to him patented."

This is the fifth patent for making cisterns of hydraulic cement, which has been obtained within little more than a year, and all of them by persons living in the same district of country. The first was that of Mr. Booth, above alluded to; the others are noticed in vol. xiii., p. 322, and vol. xiv., p. 25, and p. 232. The latter, patented by Messrs. Fortin and Van Vleck, is, in its mode of construction, in all essential points, identical with the one before us. In examining those previously patented, (with the exception of Mr. Booth's,) we have offered such general remarks as were suggested to us by the subject, and which, therefore, it is unnecessary for us to repeat. We shall, at an early day, append to our monthly lists, an account of the ten omitted patents, when, of course, Mr. Booth's plan will be described.

19. For an improved *Reaction Water Wheel*; John L. St. John, Canajoharie, Montgomery county, New York, September 16.

The patentee states that he has invented a new form of wheels, and improved those already in use. In the new form, the wheels are to have openings at or near their edges, through which the water is to pass, entering them at top, and being delivered below, as nearly as may be at a right angle to the radii of the wheel, and at as small an angle with its face as possible; the wheel, of course, revolving horizontally, with a vertical shaft. The following proportions are given for a wheel of thirty-two inches diameter. Such a wheel may be

three inches thick, and have six openings for the passage of the water through it; when made of wood, the rim may be two inches wide, and the buckets eight; the centre, or unperforated part, of the wheel, will then be twelve inches in diameter.

Sometimes, it is observed, it may be best to allow the water to issue from the periphery, horizontally; that is, in the manner of the reaction wheels most commonly used; and directions are given respecting the manner in which it may be so formed.

The improvements which the patentee makes in wheels already in use, are stated to be four in number: First, using less lapping of the ends of the buckets than usual. Second, leaving less lapping by the sides of the issues. Third, altering the wheel, so that the water will not be pressed by it. Fourth, altering the wheel, so that the water can pass more readily to, and through it, without friction.

Some of the things proposed to be done, are not very clearly explained, whilst others are impossible; as, for example, the leaving of less lap in the buckets of reaction wheels than has heretofore been done, the fact being, that many of them have no lap at all. The new form of wheel described, is old; nor have the things claimed any common connecting principle to justify their being combined in the same patent. The drawing is altogether inadequate, and is without written references.

The claims made are to "The new form, or forms, of wheels, as described in the first part, and to the improvements as explained, and the various improvements as described, in the second part."

20. For a *Handling Machine*, to be used in the manufacturing of Leather; William G. Waterman, Sullivan, Madison county, New York, September 16.

A reel, about eighteen inches in diameter, and ten feet in length, formed of slats, is to be sustained upon a frame, so that it may be made to revolve by means of a crank. The skins to be handled are to be tacked together, and whether in the process of liming, or tanning, they are to be deposited in the place required, by means of the reel.

We are much mistaken if such handling machines have not been in use in many tan yards, for a number of years.

21. For an improvement in the form and construction of *Grid-irons*; Fenner Bush, and Linus Pratt, Meriden, New Haven county, Connecticut. First patented July 21st, 1832. Patent surrendered, and reissued upon an amended specification, September 17.

For our observations on the patent, as originally obtained, we refer to vol. xi., p. 101. In the deed of surrender, the patentees state that their former claims, through inadvertence, included more than that of which they were the original inventors; their present claim is as follows.

"We do not claim that a revolving gridiron, merely, is a new invention, nor that a gridiron with only fluted or channelled bars, and

apparatus for saving the drippings, or juices, is a new improvement, for gridirons of these descriptions have heretofore been made by castings, or otherwise. But our claim is, that the construction and combination of the two parts of the above described gridiron in such a manner as to secure all the advantages of channelled or fluted bars, and dripping pan, in connexion with a revolving motion, is a new and useful improvement, and we solicit our patent to secure to ourselves the exclusive right to make and sell gridirons which have a revolving motion, with channelled bars, and one or more receptacles for the juices of the substances broiled thereon. And we claim no part, or parts, of the above described instrument, except such as are necessary to combine those two advantages, viz. the revolution of the upper part, and preservation of the juices evolved by heat from the substances placed upon the gridiron, and exposed to the action of the fire."

We have little doubt that the claim, as now limited, can be sustained.

22. For a *Straw Cutter*; Nimrod Murphrie, Nashville, Davidson county, Tennessee, September 17.

A fly wheel is to be made, either of wood or of cast iron, and this is to be turned by hand, or by a treadle attached to a crank. A knife, curved like a sickle, and of proper stiffness, is to be secured on one face of the wheel, by means of bolts, and a feeding trough is to stand at right angles thereto, to receive the straw. A claim is made to "the general arrangement of the machinery; to the manner in which the knife is made fast to the wheel, and the mode of applying said knife to the purpose of cutting straw."

The patentee appears to think that, although a crank and treadle are well known parts of machines, yet, if they have not been applied to the cutting of straw, precisely in the way in which he has applied them, he might claim these also. We are of opinion that they would have been equally secure with the claims which he has made, no part of the machinery having the slightest claim to novelty, unless the employment of a screw more or less in putting a thing together, is a discovery upon which a patent can be sustained.

23. For *Sun Dials of Cast Iron*; Heman M^cCluer, Hamburg, Erie county, New York, September 17.

All the information derived from the specification is, that "the dial is of the common form, with the improvement of being made of cast iron, and of a large size, sufficient for regulating clocks and watches."

Maugre the terrors of the patent law, with its triple damages, we should feel ourselves at the same liberty to make a dial of cast iron, as of bronze, tin, or any other metal, or mixture of metals; yet the patentee would pretend that his rights were invaded in one case, although not so in the other.

24. For a *Horse Power*; Sewall Gleason, Westville, Franklin county, New York, September 18.

We noticed a horse power among the patents for August, p. 99, No. 20, in which the slats forming the inclined plane upon which the horses are to walk, are to be supported by blocks, or stops, rising above them; and we refer the reader to the remarks there made, they being, in general, as applicable to the plan before us, as to the one there proposed. In the present instance, there are to be catches of wrought or of cast iron, attached firmly to the under sides of the slats composing the inclined plane, which catches are to hook into each other, so as to constitute bearings to support the plane, and to give to it, if desired, an arched form. A mode of gearing in a way different from that usually adopted, makes a part of the claim; the main feature of novelty, however, is the manner of supporting the floor; and this is by a pulling power, in the manner of the links of a chain, instead of the thrust against the stops, when these are placed above the slats; we do not perceive that the contrivances here claimed afford any advantage over the former, nor do we believe that a machine made on either of these plans will be permanent.

25. For a *Rotary Steam Engine*; William Sutton, Geneva, Ontario county, New York, September 18.

The general construction of this steam engine is the same with that of Foster and Avery, patented September 28th, 1831, which, we remarked, (vol. ix., p. 171,) resembled the first which we have upon record, being described in the "Spiritualia" of Hero of Greece. The steam is to be admitted into a wheel with hollow arms, and is to



turn the said wheel by its reaction, as it issues from openings in the rim. To admit steam, the axis upon which the wheel revolves is made hollow, and through this it passes into a hollow hub, thence along the openings through curved arms, and the rim of the wheel; the channels through which it passes being represented by the dark lines in the accompanying sketch. The wheel is to revolve in a hollow metallic drum, as likewise does that of Foster and Avery, above alluded to. The main difference between the wheel before us, and those which have preceded it, is in the "orifices pierced through the rim, running diagonally at about forty-five degrees from a line drawn through the centre of the hub to the rim of the wheel."

The patentee says, "It is to be understood that what I claim as my invention, or improvement, is the hollow expansion hub, together with the hollow wheel, by means of which the steam is confined until it is conveyed on to the stops, or buckets, across the hollow within the rim of the wheel, which causes the wheel to move in the same direction of the steam; also the manner in which the steam is discharged from the wheel, it being discharged in a contrary direction from that in which the wheel moves, thereby obtaining, by the com-

bination of the action and reaction, the assistance of the reaction, so as to cause it to work in concert with the direction."

We are altogether unable to follow the patentee in his views, or to discover any possible advantage to be derived either from the curvature given to his steam ways, or from the reversed direction of the steam before its exit. Nor can we conceive in what way he secures any extraordinary concurrence of action and reaction; this is certainly the poetical part of the subject, being entirely the work of imagination.

26. For a *Churn*; Adna L. Norcross, Hallowell, Kennebec county, Maine, September 19.

A common dasher churn is to have a frame above and about it, to sustain a band wheel, crank, and fly wheel, by which to work it; an affair so old, and so trifling, that, were it not for the constant recurrence of patents for such things, we might well be surprised to meet with it.

27. For *Shears for Cutting Metal*; George Christian, Mentz, Cayuga county, New York, September 20.

If a pair of shears of the ordinary form be taken, and the handles converted into blades, there will then be shears on each side of the fulcrum; and such is the case with those which form the subject of this patent. A lever fixed upon the frame which holds the shears, serves to force one of the blades down by means of an eccentric. The frame, braces, thumb screws, &c., are particularly described; but we find nothing in these worthy of special notice, or any result obtained by them which could not be accomplished equally well in other ways. The claim is, "that two pair of shears are constructed in one machine, being a new improvement; and the principle of the lever, M C, [referring to the drawing,] is applied to the shears, which is a new invention, as well as the ways of regulating the shears, which is also a new improvement."

If the two pairs of shears could be worked with the same power as one, this would not have been merely a new, but really a very great and a very useful improvement; but, as the matter stands, it appears to us that the novelty far outweighs the utility.

28. For an improvement in the *Forcing Pump*; James D. Egbert, Lansing, Tompkins county, New York, September 22.

Here there are to be two barrels, and other appendages, as in the ordinary fire engine, and the piston rods are to be worked by a double crank shaft above them. The whole affair is without the slightest claim to novelty, either in form or arrangement, in any one point. We, as well as the advocate employed, should really smile at the idea of commencing an action against any one for a violation of this patent.

29. For a *Horse Power*; Silvanus Leonard, Hampton, Penobscot county, Maine, September 23.

This horse power has a vertical shaft, which is to be turned round by a lever, or sweep, in the usual way. A bevil wheel on this shaft gears into a pinion on a horizontal shaft, which gives motion to another wheel and pinion, and to a band wheel for driving a thrashing, or other, machine. The band from this wheel is to be conducted by pulleys, so as to pass below the horse path.

The patentee claims "the above peculiar arrangement, or combination, of the several parts, for the purposes above mentioned. And separately and singly, as a part of this combination, I claim guiding the belt in its passage from the pulley, in a direction under the feet of the horse path, or platform, by small pulleys."

The combination by which the gearing is effected, is of that simple and ordinary character as not to possess any claim to the title of an invention, or discovery. The conducting of the belt under the platform, we do not think new, and, in numerous instances, for centuries past, the motion has been so conducted by means of a revolving shaft.

30. For an improvement in the *Cast Iron Fireplace*; Ansel Hayward, Easton, Bristol county, Massachusetts, September 25.

The claim in this case will indicate pretty clearly what is considered as new in this contrivance. "All that I claim as my said invention, notwithstanding what may be hereinbefore stated, is the application of a hot air chamber near the top of the common fire frame, supplied with cold air through one or both of the front pillars, or otherwise, for the double purpose of heating rooms, and affording an oven always ready for use. I also claim as my invention, the circular form of the top of the fire frame, whether used for a hot air chamber, or not."

The hot air chamber is to be surrounded by the flue from the fire, and the cold air introduced through the columns, is to pass between two plates, above the fire, before it enters this chamber. A valve opens to let the heated air into the room, and a door at the other end of the air chamber gives access to it, when it is to be used as an oven. The circular form of the top is intended to adapt it to the hot air chamber, and seems not worthy to be claimed alone, as it is merely accessory to the other parts; and besides this, circular tops, forming the upper part, or exterior of the throat, of a fireplace, have been previously used. The *model* is referred to for illustration, a proceeding altogether incorrect.

31. For an improvement in the *Dress of Mill Stones*; Isaac W. Elmore, Lyons, Wayne county, New York, September 25.

This improvement is said to consist, "1st. In giving to the furrows of mill stones a greater degree of angle, or draft, at and near the region of the verge of the stone, in proportion to the degrees of angle, or draught, near the eye, or centre, than has heretofore been used. 2d. In giving to the furrows, at and near the region of the verge, a greater degree of angle, or draught, than has heretofore been used,

or given to the furrows of mill stones, in which the degrees of angle, or draught, were equal in the furrows."

"The amount, or degrees, of angle, or draught, which I claim as part of my improvement, or invention, may be determined in the following manner, to wit: By using the segments of circles of any diameter, from seven to three feet, and also the segments of circles of all or any intermediate diameter between those of seven and of three feet, on a stone the diameter of which is five feet, and in that proportion for stones of any other diameter, as follows: Place one of the points of an instrument proper for sweeping circles, at as near the centre of the stone as you choose, or, in other words, commencing with or without draft at the eye, using the other point as a pivot, and sweep, or describe the segment of a circle from thence to the verge; the radius, or sweep, used must be in proportionate length to the diameter of the stones to which it is applied, in the ratio above claimed."

The general principle upon which the patentee proceeds, being thus given by him, he goes on to state, particularly, the practical means of carrying it into operation, and institutes a comparison between this and the ordinary mode of procedure, in a manner which shows a competent acquaintance with the subject. We cannot follow him through this course, nor are we able to decide upon the merits of his plan; a question which, we apprehend, cannot be satisfactorily settled, otherwise than by actual experience.

32. For a machine for *Thrashing and Cleaning Grain, and for Shelling Corn*; David Knauer, East Nantmeal, Chester county, Pennsylvania, September 25.

This machine, as represented in the drawings, is made in the form of that ordinarily used for cleaning grain, and contains fans and riddles constructed in the usual way. Above the cleaning part, there is a cylinder and concave, which have nothing new in their construction. When used for cleaning rice, the beater cylinder is to be changed; and when employed for shelling corn, a sheller of a particular construction, but not very clearly described, is to take the place of the thrashing apparatus. The claim preferred, is to "the general construction and arrangement of the different parts of the machine for thrashing and cleaning grain at one operation, as before described, but particularly the mode here described of shelling corn."

We esteem this patent objectionable on several accounts. There is no novelty either in the thrashing or winnowing machines, nor is there any in the combination of the two. The machine for shelling corn is separate and distinct from that for thrashing, and is merely to be put into the same frame, after removing the former; the patent, therefore, covers two machines, instead of one. When rice is to be rubbed out, another apparatus is also to be substituted for the thrashing machine, and appears as a third member in the family, but related to each other by marriage only.

33. For a *Centripetal Power Press*; Eliphalet S. Scripture, Cazenovia, Madison county, New York, September 26.

In the description of this press, the machine is spoken of as constructed upon a new principle, whilst to us it appears like an old acquaintance, very little altered by time or dress. It is, in fact, a compound lever press, in which the lever that is to make the pressure is to be placed horizontally, and to work upon a pin in a vertical standard, on one side of the frame, its other end working up and down between two vertical standards, where it is acted upon by a second lever, connected to it by links, which operate like the toggle joint. The follower, or pressing part, is on the lower side of the first named lever. This press is spoken of as capable, under different modifications, of being applied to a great variety of purposes, among which are mentioned, printing; packing goods, such as cotton, flour, tobacco, hops; extracting oil, and other juices; also, pressing for clothiers, paper makers, harness makers, dairy men, &c.; impressing and cutting metals, &c.

From the smallness of its range, there are some of these objects to which it could not be advantageously applied; whilst for others to which it is more particularly adapted, it has long since been employed.

34. For *Water Wheels*; Garret H. Heermance, Coxsackie, Greene county, New York, September 30.

This water wheel is "to propel all kinds of machinery, rail-road cars, vessels, or boats," &c. The construction of the wheel is the same with that of some rotary steam engines which we could point out in the books. A circular drum is to be used, the periphery and ends of which are to be perfectly true, and a wheel, with valves, or buckets, is to be made to revolve in this drum; this wheel, and its valves, must fit perfectly tight, but revolve freely between the heads, and the valves are to slide, air tight, but freely, into openings made in the wheel to receive them. A rod connecting two opposite valves passes through the wheel, so that, as one slides into the space prepared for it, the other is protruded. Two blocks, or stops, on opposite sides of the drum, and about one-third of the circumference of the circle apart, touch in one point, the periphery of the revolving wheel, and serve to retract and protrude the valves. Water, under a sufficient head, is to be let in, to act upon the valves, or buckets, and is to be discharged at another opening. In rail-road engines, &c., where there is not a sufficient head of water, it is to be pumped up by hand, steam, or otherwise, into a reservoir, and used over and over again. All who know anything of mechanics, will now be ready to exclaim, "Stop there, we have heard enough;" and as we think so too, we will merely add the claim, without a word of comment.

"What I claim as new, and as my invention, is the construction of the above described water wheel, on the principle of hydraulic pressure, as applied to water wheels, and the producing a vacuum under

the valves of the wheel, by forcing pumps; and also the principle of propelling rail-road cars, boats, or vessels, by water power."

35. For an improvement in *Stoves for Burning Anthracite*; William A. Hopkins, city of New York, September 30.

A stove is to be made in the general form of the Franklin stove, and this is to receive a grate for burning anthracite. The grate bars are to be continued round on the back, as well as on the front, and they are to stand at such distance from the back of the stove as to allow a free draught. There are to be doors in front, by which the whole may be enclosed. A narrow horizontal flue is to be continued back from the stove, just above its top; this is to be surmounted by an oven formed of double plates, allowing the heated air to circulate around it. A partition is to divide the flue surrounding the oven into two parts, and at the top of it there are two exit pipes, which are to be made to unite above it in one common flue.

The stove is described without any claim being made, the patentee probably supposing that it is new in all its parts.

36. For a *Tin Baker*; Josiah St. John, Hudson, Columbia county, New York, September 30.

This baker may be made of tin, or other sheet metal, and the form generally given to it is that of an oblong box, with circular ends. In each of these ends, there is a furnace sufficiently large to contain a quart, or more, of charcoal, there being grate bars under the furnaces, made in the usual way. The box between the furnaces constitutes the oven, and boiling is effected in vessels fitted into openings just above each furnace.

The dimensions given for an ordinary sized baker, are the following. The body, in which is the oven, two feet in length, by one foot in height and width, with a door on the front side. A circular projection on either end for the furnaces; these projections may be eight inches in length, and nine in height. There is to be a flue from each end, uniting at length in a common pipe.

We have heard a very good character given of this apparatus, by persons who have had it in operation in the city of Washington; it is intended principally for summer use, to which it appears to be admirably well adapted. The quantity of fuel consumed is said to be very small, and, indeed, from the size of the furnaces, this must be the case, much of the effect depending upon the reflecting and non-radiating property of the tin plates. We do not think it necessary to give the claim, as it does not so clearly express the nature of the invention as was to be desired; the invention itself might also have been set forth in a much better manner than it is in the specification. We intend making trial of one of these ovens, and should it justify the character given of it, we will report progress.

TRANSLATIONS FROM FOREIGN JOURNALS.

On the Use of Anthracite in the Smelting Furnace of Vizille. By
*M. ROBIN, Director of the Neiderbrunn Works.**

(Translated for this Journal, by S. V. Merrick.)

The Alps, and particularly the department of Isere, so rich in the various productions of the mineral kingdom, furnish many specimens of anthracite. No locality is better provided, in this respect, than the canton of Launure, situated seven leagues south of Grenoble. The amount of this combustible there procured, has been, for some years, sufficient to supply, in a great measure, the domestic wants of a radius of more than ten leagues.

This coal is also used in the arts, and is employed with advantage in burning lime and plaster, and as a fuel for steam boilers. It has been successfully used, also, in working copper ore, and in the rolling of sheet iron.

In other countries, and particularly in England, attempts have been made to use anthracite for the fusion of iron ore, but without any satisfactory results.

This combustible, mixed in the proportion of only two-tenths to eight-tenths of coke, occasioned derangements in the working of their furnaces, so that they have not cared to exceed this proportion. These unfavourable experiments indicate the caution with which the solution of this difficult question in metallurgy should be attempted.

In 1824, when the industry of France made a sudden extension, an establishment was put in operation at Vizille, specially intended for the fusion of the earthy carbonate of iron, by the anthracite of Launure. The company who erected it, having large means at their disposal, spared nothing to overcome the difficulties of this hazardous enterprise, which was condemned beforehand by those engaged in the art; they thus laid out more than 500,000 francs in the construction, and in experiments continued during four years; but obstacles which seemed insurmountable, made them at last despair of success, and induced them to renounce their project. The interesting results obtained during these trials, are worthy of being recorded in the annals of science.

To understand this communication, requires some details upon the first matters employed at Vizille.

The anthracite found in the canton of Launure, forms numerous beds, of different inclination and thickness; their direction varying between one and two degrees. These beds are contained in a sand stone, which rests commonly upon talcose slate, and has been regarded as belonging to the transition rocks;—more recent researches have, however, shown that the overlying limestone, which was formerly considered to belong to

* Annales des Mines, 1834.

the transition rocks, contains the fossils which are characteristic of the lias formation. The alternation of this limestone with the sand stone, establishes the fact that the latter belongs to the secondary groupe of rocks.

The examination of the numerous vegetable impressions which occur in the sand stone, throw some doubt upon this hypothesis, there being, in most of these plants, a perfect analogy of character with those from the sand stone which accompanies bituminous coal, whilst they have nothing in common with the lias.

Either hypothesis would conflict with the received ideas in relation to the distribution of fossil plants and shells in the geological formations.

The anthracite sand stone varies much in colour; its grain is usually large; it contains some particles of mica; as it approaches the coal, it becomes slaty, its grain is finer, and it is of a deep gray colour; vegetable impressions, and iron pyrites, abound in it. The anthracite is sometimes solid, sometimes friable; but it is remarkable that the two varieties have never been found united in the same bed.

In general, the thickest beds, varying from five and a half to twenty-one yards, give a compact variety, which is the only one that has been used at Vizille. This variety is of a perfect black; its lustre, slightly metallic, is greater than that of bituminous coal. Sometimes it is irised; the fracture is conchoidal, when it is made in the mass; at other times, it is lamellar, following the little strata of schistus which traverse it, as in the bituminous coal.

The anthracite, in breaking, follows small white veins, principally calcareous, which traverse it in different directions, and which fill the fissures, which were, doubtless, formed in the coal by fire. It is also according to these veins that the anthracite breaks up, when stored, causing a very considerable loss.

Its density is very great; the cubic foot, such as passed to the furnace, weighed fifty-one and a half pounds, (not picked, its weight was sixty-seven pounds,) whilst the weight of coke of the Rive-de-Gier, is from $20\frac{1}{2}$ to $23\frac{1}{3}$ pounds, only, and that of charcoal varies from $9\frac{1}{2}$ to 13 pounds.

By reason of its great compactness, the anthracite kindles with difficulty, and consumes slowly. On the fire, it possesses a property that no other coal possesses; it is reduced into fragments, of which the size is usually regulated by the small veins before mentioned. It would appear that the expansion of the vaporized water has less to do with this phenomenon than the dilatation of this dense matter; for the same thing takes place with well dried coal, and if the heat is so strong that the masses do not become gradually hot, they fall into small pieces, like those from a mass of cold glass, under the same circumstances. To these properties of anthracite, namely, that of burning slowly, and of dividing itself in the fire, are to be attributed the little success which attended the experiment at Vizille.

Another defect of this coal, though less prejudicial than the preceding, is the quantity of pyrites it contains, often visible to the eye;

it is generally spread through all the grand divisions of the mass, and disengages, when burning, a very marked odour, which denotes its presence. The anthracite burns with a feeble, blueish flame, and does not give off the least smoke. Submitted to calcination, its loss, which is almost insensible, may be attributed to a little moisture, and carbonic acid, corresponding to the carbonate of lime contained in its ashes; it contains no bitumen. When it is of good quality, its residuum by incineration is less than four per cent.; in other cases, it rarely exceeds ten per cent. In respect to its purity, this combustible, therefore, leaves little to desire, for the cokes of Loire give eight, and even fourteen per cent. of ashes.

The ashes of anthracite* give the following constituents, the analysis being a mean of experiments on a large quantity.

Silex,	.	.	.	58.4
Alumine, and oxide of iron,				40.
Lime,	.	.	.	1.6
				100.0

Those of the coke from Rive-de-Gier, employed at Vizille, contain:

Silex,	.	.	.	57.8
Alumine, and oxide of iron,				34.4
Lime,	.	.	.	7.2
				99.4

Before it was sent to the furnace, the anthracite was carefully picked, and broken in pieces the size of the fist; the slate, and also the pieces of coal which were less than a walnut in size, being rejected. This selection produced an enormous loss; thus the provision for one year gave the following results, from 414,812 kilograms.

Coal for the furnace, large pieces,	210,672 kilogs.	50.8 per cent.
Small coal,	74,973	18.1
Dust,	117,267	28.2
Slate,	11,900	2.9
414,812		100

The loss on coals freshly mined was not so great, the mean of three trials having given,—

* The mean of several analysis of the ashes of the Tamaqua Anthracite gave
 Profs. Rogers and Bache,

Silica	47
Alumina	36
Oxide of Iron	14.5
Lime	1.5
Magnesia	1.0

being eleven per cent. less of silica, and ten per cent. more of alumina and iron, together, than in the anthracite under discussion.

[See *Journ. Acad. Nat. Sci.* Vol. vii. Part 1.

Coal fit for the furnace,	60.8
Small coal, ...	9.1
Dust, ...	26.9
Slate, ...	3.2
	100.0

If the establishment had prospered, the small coal would have been used advantageously in the puddling furnaces, as may be seen in a note upon the refining of iron by means of anthracite, (*Annales des Mines*, No. 4, 1829;) but the major part of the dust gives a real loss, since it can only be used in small quantities, to roast the ore, and calcine limestone, or plaster.

Minerals.

It would be superfluous to mention all the minerals which have been discovered in the numerous veins and beds in the trap formation, which breaks out at Vizille, and extends over a great part of the Alps. It will suffice to say a few words in relation to the minerals which have been principally employed in these trials.

Two different varieties of ores are distinguished by their properties, as well as by their richness; some are magnesian, others contain lime, in addition. These last would be too poor to be worth working, if, on account of the low price at which they are obtained, and of their composition, they were not found useful as good fluxes. For want of it, they employed a flux obtained from the lias limestone, in another quarry, near which smelting furnaces had been constructed.

Two analyses of each of these kinds of ore, have given the following results.

<i>Iron Ore of Pierre-plate.</i>		<i>Iron Ore of Halles.</i>	
Quartz,	2.60	Quartz,	4.20
Carbonate of iron,	82.80	Carbonate of iron,	67.67
Carbonate of manganese,	3.40	Carbonate of manganese,	1.16
Carbonate of magnesia,	11.20	Carbonate of magnesia,	24.78
		Pyrites,	1.64
	100.0		
			99.45

<i>Ore from the great vein.</i>		<i>Ore of Cauriglion.</i>	
Quartz,	1.08	Quartz,	4.20
Carbonate of iron,	26.16	Carbonate of iron,	24.51
Carbonate of manganese,	0.85	Carbonate of manganese,	1.20
Carbonate of magnesia,	23.14	Carbonate of magnesia,	20.65
Carbonate of lime,	48.23	Carbonate of lime,	48.24
	99.46		98.80

The foundry of Vizille has been sometimes worked with the veins of decomposed carbonate of iron.

The smelting of this mineral is analogous to that of a roasted ore, which has been exposed to the air for a long time. Worked on a large scale, the rich ore will have fifteen to twenty per cent. of gangue; the other much less. During the roasting to which it is usually submitted, the first loses from 15 to 18 per cent. in carbonic acid alone; it then yields from 38 to 42 per cent. in the furnace. But this operation, which was at first practised at Vizille, has been abandoned, because the ore is reduced to powder by cooling, when taken from the roasting kiln. The furnace being charged with ore, and with anthracite, which also falls to fine dust, the passage of air through the mass becomes almost impossible.

The ore for charging was there used in the crude state, but reduced to fragments a little smaller than the coal.

The question whether the carbonate of iron, of which the reduction is in general so easy, presented difficulties in working with anthracite, had also excited the attention of metallurgists. It has been favourably answered; this variety of ore leaving nothing to desire on this head.

Furnace.

The furnace constructed to make the trials, was the same as the coke furnace, and its dimensions moderate.

The whole height, from the bosh to the trunnel-head, was 13 metres. (43.4 feet.)

The hearth was 2.25 m. (7.6 feet) high, 0.65 m. (2.1 ft.) wide, and 0.70 (2.4 feet) long.

The furnace was conical, and from the hearth to the beginning of the boshes was 1.80 m. (6 feet) in height; near the hearth, its diameter was 0.65 m., (2.6 inches;) at the boshes, 1.2 m., (4 feet.)

The boshes were in the form of an eight-sided pyramid, were 1.5 m. (5 feet) high, and at their junction with the furnace above the breadth, were 3.15 m., (10.5-feet.)

The height from the hearth to the head of the bosh, amounted to 4 m., ($13\frac{1}{2}$ feet,) and from this position to the trunnel-head, 7 m., ($23\frac{1}{2}$ feet.) The diameter of the latter was 1.2 m., (4 feet,) and it was surmounted by a chimney, 4.25 m., (14.2 feet.)

The interior of the furnace was entirely constructed of fire brick, of Bollene clay, mixed with silicious sand.

Of the three tuyeres, two were placed upon the sides, the other a little higher, opposite the tump, facilitating the variation of the blast at pleasure.

Bellows.

A blowing machine, of eighty horse power, gave ample and perfectly regular blasts. The blast furnace was put in operation, for the first time, on the 13th of April, 1827. It was natural to suppose that, with a new material, unforeseen difficulties

would arise. To avoid them as much as possible, and to encounter them by degrees, fire was made, in the first place, with coke of Rive-de-Gier, to which the anthracite was added successively by tenths. No accident happened with the use of coke alone, but the carbonate of iron gave metal of excellent quality.

The first three tenths of anthracite passed without trouble, but during the addition of the following two tenths, the working met with frequent derangements, which were attributed, in part, to the tenuity of the ore which was roasted, and also to that of the anthracite, but more especially to the delays occasioned by accidents to the blowing machine. The last rupture in the blowing apparatus compelled them to allow the fire to go out, on the 21st of June, after seventy days work.

(*To be continued.*)

REPORT

To the Board of Directors of Bridges, Public Roads, and Mines, upon the Use of Heated Air in the Iron Works of Scotland and England. By M. DUFRENOY, Engineer of Mines. Paris, 1834.

[Translated for this Journal, by S. V. Merrick.]

Continued from p. 220.

ENVIRONS OF DERBY.

The coal basin of Derby, a prolongation of that of Sheffield, contains many large iron works; three of them, the Butterly, Codnor Park, and Alpdon works, have adopted the hot air blast. I visited the first two, under the charge of Mr. Jessop, one of the most intelligent iron masters in the kingdom. The heating apparatus of all these differ from those I have described, and, in some essential respects, from each other. For this reason, I have deemed it proper to describe them in detail, though the results which they give are not so favourable as those obtained at the Calder works.

Butterly Iron Works contains three smelting furnaces. The iron there made is intended for castings, either of first or second runnings. One furnace only was in blast when I visited Derbyshire. The air for the blast was heated by an apparatus at each tuyere; this apparatus, plate 3, figs. 11 and 12, was composed of the large pipes, A B C, twenty-seven inches diameter in the clear, placed horizontally one over the other, and separated by arched plates, *m n, m' n'*. These pipes are connected in pairs, by elbow pipes, *d c, d' e'*. The air from the blast engine enters by the pipe *c*, and makes its exit at *g*, after having passed the length of the three pipes successively. The joints are placed on the outside of the furnace proper; but to prevent the air being cooled in traversing the elbows, they are cased in brick-work.

The elbows connecting the long pipes are in plates, connected by bolts and nuts, passing through lugs, or flanges. The pipes are one

and a half inches thick, and rest upon fire lumps, *t t*, placed at proper distances upon the arch plates, *m n*, *m' n'*. This disposition allows the flame to envelop them on all sides.

The first pipe, *A*, is not exposed directly to the action of the fire; it is separated from the grate by an arch of brick, extending the whole length of the furnace, which allows the flame to pass by the flues, *v v*. The partitions, *m* and *n*, have openings, *p* and *q*, placed at the opposite ends of the furnace, so as to compel the flame to traverse the whole length, without escaping from one story to another. All the arches are of fire brick, one brick thick. The expenditure of this apparatus is 62 cwt. for each ton of casting made. The air is raised to 360° Fahr. Notwithstanding the feeble temperature, a great economy of fuel is effected, as indicated below.

Consumption and Products during the first week in July, 1830, from furnace No. 2, worked with cold air.

159 tons 5 cwt. of coke, corresponding to

tons.	cwt.
218	10 of coal,
109	17 of ore,
35	of flux,

Produced 83 tons of metal.

Consumption and Products of furnace No. 2, on the 17th of July, 1833; heated air being used.

The furnace received forty-one charges, each composed of—

9 cwt. crude coal,
9 “ ore roasted,
3 “ flux.

The average of the first fortnight in July had been forty charges per day, and the iron produced seven tons.

Upon comparing, from these data, the consumption of the two periods, one ton of iron required as follows:

1830. <i>Cold Air and Coke.</i>			1833. <i>Heated Air and Coal.</i>		
Coal,	5 tons	16 cwt.	Coal,	2 tons	18 cwt. incl'g fuel
Ore,	3 “		Ore,	2	11 [to heat the air
Flux,	1 “		Flux,	1 “	

To know the whole expense of fuel, that used by the blast engine must be added, for which I have no precise data; but this expense must necessarily diminish in proportion to the increased yield of the furnace.

At Butterly, therefore, a saving of one-half the fuel has been effected by the introduction of the new plan. The quantity of flux

remains the same, because the sulphurous nature of the coal requires a large proportion of lime.

The blast engine, which served but two furnaces, now works three; but to obtain this increase, a larger cylinder was put in. Formerly, the cylinder was seventy inches in diameter, and eight feet stroke, working thirteen revolutions; now, the cylinder is eighty inches, the length of stroke, and number of revolutions, remaining the same.

The quantity of air expended, which was 2,500 cubic feet per minute, is now reduced to 2,160 feet; but the pressure, two and a half pounds to the inch, has undergone no variation. The opening at the mouth of the tuyere has been reduced from two and a half to three inches; the iron produced is intended for castings.

Codnor Park Works.—This work consists of three furnaces, three refineries, and a sufficient number of puddling furnaces to work up all the metal. These furnaces have worked for the past year with heated air, and crude coal. The substitution of heated air has produced a saving of fuel similar to that stated for Butterly; 2 tons 9 cwt. being now sufficient to obtain one ton of metal, which formerly required five tons. It should be remarked, that the expense of coal has always been less at Codnor Park than at Butterly, on account of the difference in the quality of iron produced. This difference would be much more sensible, if the same quality of coal was used at both works; but at Codnor Park the soft coal is used, while at the other a variety called cherry coal is used, which better resists the action of the blast.

Consumption for one ton, using Cold Blast.

Butterly,	.	.	.	5 tons 16 cwt.
Codnor Park,	.	.	.	5 "

Same with Hot Air.

	Butterly.	Codnor Park.
For smelting,	2 tons 12 cwt.	2 tons 9 cwt.
" apparatus,	6	6
Total,	2 tons 18 cwt.	2 tons 15 cwt.

The apparatus employed at Codnor Park, for heating the blast, is composed of two pipes, A and B, plate 3, figs. 13 and 14, placed one above the other, in which are inserted small pipes, *a b*, having the same centres as the large pipes, A and B. These pipes are connected by elbows, so that the air, in passing from the blast engine, through the interior pipe, *b*, spreads itself over the circular space, *c d*, between the pipes B and *b*; passing then into the second interior pipe, *a*, is transmitted to the furnace by traversing the second circular space, A.

This disposition of double pipes, one within the other, was adopted

to remedy a serious inconvenience experienced at Butterly,—an inconvenience incident to pipes of large diameter, in which the air being heated unequally, a current of cool air passes along the centre of the pipe, and renders it impossible to raise the temperature sufficiently.

The pipes, A B, are of cast-iron, thirty inches diameter outside, and one and a half inches thick; the small pipes, *a* and *b*, are of boiler iron, six-tenths of an inch thick, and eighteen inches diameter in the clear. The construction of the furnace is the same as at Butterly, figs. 13 and 14 giving an exact idea of it. The air is heated, by means of this apparatus, to 400° Fahr., with a consumption of 6 cwt. coal.

We have already stated that all the metal made at Codnor Park is made into malleable iron;* this iron is used in the machine shops of Mr. Jessop. It serves equally well for boiler iron for steam engines, a use which requires the very best metal.

Environs of Birmingham.

The introduction of the hot air blast has scarcely commenced in the Staffordshire iron district, the opinion being still prevalent that the quality of the iron is deteriorated by its use, has retarded the trial of it until within a year past. One work only, near Wednesbury, belonging to Messrs. Lloyd, Forster & Co., uses the heated air. The success attending this experiment determined the proprietors of the other works to make similar trials.

The apparatus employed here is placed above the trunnel head of the furnace, and is the only one at which such an arrangement has been effected in England. It is composed of a solid pyramidal ring, (plate 3, figs. 15 and 16,) A B C D, and a series of small tubes, *t*, which penetrate into the furnace.

The interior surface of the ring, *a b c d*, is a cast iron cylinder, four feet in diameter, and twelve feet in height, in place of the chimney which usually surmounts the trunnel head of the furnace. The exterior surface of the pyramid is octagonal, and made of boiler plates, riveted together, like a steam boiler, its diameter at the middle being six feet; a space is left between the surfaces, of one foot on all sides; to protect the outer surface from the cooling action of the air, it is encased in brick-work.

The air passing from the blast engine, is carried to the top of the furnace, circulates through the pipe, *e e e*, on a level with the top of the furnace, then divides itself among the eight vertical pipes, *f g*, placed round the outer surface of the casing, which are connected with the circular pipe; each of these vertical tubes communicates with the interior of the case, or pyramid, by six small tubes, which pass into projections within the interior of the furnace.

This part of the tubes, *t*, enters into the pipes, *t'*, closed at the

* This is an error, as large quantities of pipes are cast at this work for the London market.—*Trans.*

extremity; so that the air, in moving, is forced to spread itself over the surface of the heater. These tubes, *t'*, are all of cast iron, and are connected with the distributing pipes, *f g*, by leather sleeves, *t''*.

The air, after being heated in the tubes, *t'*, and in the circular heater, *A B C D*, *a b c d*, reascends to the tuyeres by the opening, *v*. To prevent the air from cooling during the transit, the conductor is placed in the chimney of the steam boiler, twelve or fifteen feet distant; a kind of brick-work connects the furnace with this chimney.

With all these precautions, the temperature of the blast cannot be raised higher than to 360° Fahr., and they are obliged to heat it again in a furnace, within a few feet of the embrasure of the furnace.

The consumption of this fire is nearly 4 cwt. of coal to the ton of iron.

This apparatus is very costly, and requires frequent repairs; the little saving of fuel effected by it, (about 3 cwt. of coal per ton of iron,) is more than compensated for by the expense of construction and repairs, and, above all, by the numerous interruptions which take place in consequence of repairs required almost daily.

The introduction of hot air has effected, in these works, the same economy as in the others cited, where this plan is adopted. One ton of iron required, in 1831, 3 tons of coke, equal to 5 tons 9 cwt. of coal; now, the same quantity of iron consumes 2 tons 14 cwt. of coal, as the following statement shows.

On the 20th of July, there passed through the furnace, twenty charges, composed of—

10 cwt. crude coal,
9 “ roasted ore,
6 “ flux.

The product being eight tons of metal, each ton consumed—

	<i>t. cwt.</i>	
Coal for fusion,	2 10	
“ for heating the apparatus,	4	<i>t. cwt.</i>
	—	2 14
Ore roasted, . . .	.	2 5
Flux, . . .	.	1 10

The consumption in flux was considerable, because of the sulphurous nature of the ore. The slag which came from the furnace was crystalline, and gave off very strong sulphurous odours. Before the introduction of hot air, the daily production of the furnace was only six tons. They have, therefore, obtained, besides an economy in fuel, a diminution of the general expenses, and of labour. The quantity of blast has not been changed, but the tuyeres have been enlarged from two inches nine lines, to three inches six lines.

Part of the iron produced at the works of Mr. Forster, is used for the foundry, and part for fine metal; the same running gives both kinds of iron; that which flows first from the hearth, is No. 1 pig metal; the last running gives No. 2. They distinguish the two kinds of iron by the manner in which they run from the furnace, and by the furrows produced on the surface, when it cools.

Wales.

There are in Wales but two works using the heated air—that of *Warteg*, and *Blaen-Avon*, ten miles from *Abergaveny*. None of the *Merthyr-tidvyl* works have introduced it, though the *Dowlais* and *Penn-y-danau* have made experiments thereon.

The abandonment of heated air in so extensive an iron country, and in which improvements are sought after with care, has led many to doubt the reality of the advantages claimed for it. Some have thought that, while so much saving was effected by the use of this plan in the furnaces of Scotland, where the metal was destined for the foundry, it could not be employed by other works, the product of which is converted into bar, or malleable, iron.

The examples furnished by the *Newcastle*, *Codnor Park*, and *Wednesbury* works, in which they make bar iron of very good quality, prove that this opinion is not well founded. The partial abandonment of the plan in Wales, should, in part, be attributed to the bad construction of their heating apparatus, but more especially to the diminished saving which would result to them, since the employment of crude coal has been effected; a saving which the cost of the patent would almost balance. To appreciate these reasons, it is necessary to enter into some details upon the expense of making iron in that country.

From all the information gained upon the experiments made at *Dowlais*, or *Penn-y-danau*, it appears that, the apparatus being of bad construction, the temperature of the air could not be raised to more than 300° Fahr. Notwithstanding this, they attempted, with success, the substitution of crude coal for coke. An accident happening to the apparatus, obliged them to suspend the use of hot air for several days, and showed them that, without difficulty, the crude coal could be worked even with cold air. The saving which resulted from this substitution was such, that the proprietors did not deem it worth while to repair the heating apparatus, and thenceforth abandoned it. Since that period, most of the Welsh furnaces use the crude coal, but some employ a mixture of coal and coke.

The following table shows the quantity of fuel and material required to produce one ton of metal.

<i>Penn-y-danau.</i>				<i>Dowlais.</i>			<i>Cyfartha.</i>			<i>Plymouth.</i>		
	<i>t.</i>	<i>c.</i>	<i>q.</i>	<i>t.</i>	<i>c.</i>	<i>q.</i>	<i>t.</i>	<i>c.</i>	<i>q.</i>	<i>t.</i>	<i>c.</i>	<i>q.</i>
Coal,	2	9	0	2	14	0	2	13	2	2	13	0
Ore roasted,	2	4	0	2	9	0	2	6	2	1	16	0
Ashes,		2	2									
Flux,	19	2		0	13	0	16					

Add to this, the quantity consumed by the blast engines, about the same for each, varying from 5 to 6 cwt.

The average quantity of coal consumed in each of these works, is,

therefore, two and a half tons for each ton of iron. By the employment of heated air, it is not probable that a saving would be effected over this expense, of more than $33\frac{1}{2}$ per cent., or 17 cwt. of coal for each ton of iron; deduct from this, the fuel consumed to heat the apparatus, estimated at 6 cwt., and the actual saving would be reduced to 11 cwt., costing, at 3s. 7d., or 86 cents per ton, at the works, 44 cents; and as the patent right is charged at one-half, or 24 cents per ton of iron, the saving would be diminished to 20 cents per ton. This economy, itself very small, would scarcely be appreciated in a district where all the materials are so cheap, that iron may be produced at a less price than in any other district in Great Britain.

I believe, therefore, that the non-adoption of this plan in Wales, is no evidence that it does not effect any saving in fuel; but, on the contrary, it leads me to think that there would be economy, as in other works where the plan is used; but it is evident that, the expense* of coal being very small in Wales, the economy would not be as marked as in the works of Scotland.

The *Warteg Iron Works*, which have been named at the beginning of this section, sustain this opinion. In this establishment, the heating apparatus is composed of a very short development of pipes, so that the air cannot acquire a temperature of more than 400° Fah. The coal, which is very bituminous, and loses 55° per 100 in the coking, cannot be employed crude in the furnace, with the air at so low a temperature; it results from these circumstances, that the saving obtained is not so great as at the furnaces of Scotland, but is to be compared to the saving in those works where the apparatus is not so perfect, and where coke is still used. Nevertheless, the diminution in the cost is very marked; before the introduction of heated air, one ton of iron required a consumption of two tons of coke; the produce of four tons, three cwt. of coal. The consumption of coke is still about the same, but, as there is no necessity for carbonizing it so completely, it is now produced by only three tons of coal.

The yield of the furnace has been augmented from six to eight tons of iron, each, in twenty-four hours.

[TO BE CONTINUED.]

¶ *Notice regarding a Series of Experiments made on the Forth and Clyde Canal, with the view of ascertaining the comparative Resistance of certain Forms of Vessels when tracked at varied Velocities.*

In the way in which experiments to ascertain the forms of least resistance of floating bodies have generally been made, so costly an apparatus, and so much precision and skill in observation, have been

* The author should have attributed this difference, in a great degree, to the superior quality of the Taff Vale coal over the Scotch, the former yielding more than 75 per cent. of carbon, while the proportion in the latter is less than 65 per cent.; some varieties even as little as 51 per cent.--[*Trans.*

required in order to give any value to the results, that comparatively few persons have been enabled to undertake such investigations, notwithstanding the obvious advantage to be derived by those interested in canal navigation, from an accurate knowledge of the forms most suitable for vessels, according to the circumstances under which they are to be employed.

The great increase of speed which has lately been effected in railway carriage, having made it expedient that corresponding improvements should be introduced into the transport of goods on canals, and it became the interest of canal proprietors to use active endeavours for this purpose. The directors of the Forth and Clyde Canal have shown themselves particularly well disposed to encourage such investigations, and have applied a considerable portion of their revenue to the construction of experimental steam vessels, and to the improvement of the facings of the canal, so as to admit of the transit of large vessels at rates of speed, which, until lately, have been supposed impracticable in confined water.

In order to obtain a maximum of effect from the power employed in such steam vessels, it was necessary to ascertain as nearly as possible the form which should be given to their bodies; and as much diversity of opinion existed on this point, I ventured to suggest to the directors that experiments should be made on the canal with models of a sufficient size to admit of safe conclusions being drawn from the results of the trials.

In consequence of this suggestion, four models were prepared, of the following dimensions:—

No. 1 was 8 ft. 3 in. long, 2 ft. wide, 1 ft. deep;

No. 2 was 8 ft. 3 in. long, 2 ft. wide, and 1 ft. 6 in. deep;

No. 3 was 8 ft. 3 in. long, 2 ft. wide, and 1 ft. 6 in. deep;

No. 4 was 9 ft. 1 in. each part, 1 ft. wide, and 1 ft. deep;

And the weight of each, $187\frac{1}{2}$ lbs.

No. 1 was quite flat on the floor, rounded at the bilges, and perpendicular in the sides at the midship section, but with a fine entrance and run.

No. 2 was made in the proportions of an ordinary coasting trader.

No. 3 in the proportions of a sharp-built schooner.

No. 4 was a twin boat, similar in its sections to No. 1, only that the breadth of each portion was half of the other breadth, while the depth was the same.

The weight of all the models being alike, their displacement of water was equal, although their draft, or depth of immersion, was necessarily different.

The usual way of trying the resistance of floating bodies, is by drawing them across a dock, or basin, by a cord running over delicately hung pulleys on a high mast, and with certain weights attached: the time is accurately noted which each form requires to move through a certain space, and the comparative resistances are calculated from these elements. This method presents many difficulties and disadvantages; and I therefore resolved on adopting a different one, which should admit of each experiment being carried

on through a much greater space than can be accomplished by means of cords and pulleys. My first intention was to tow each model by a long slender line from the after part of a light steamboat, which was capable of running about seven miles per hour in the canal. This line was to have been attached to an hydrostatic dynamometer, and by this means, the strain exerted on the towing line at every different rate of speed by each of the models *in succession*, might have been approximated. I was enabled, however, by a suggestion from an ingenious friend, (Mr. Oldham, of the Bank of Ireland,) to adopt a much more summary and satisfactory way of determining the comparative resistances of the different models; and as it was the *comparative* resistance alone which required investigation, there could be no inducement to go through the more tedious process of trying the resistances separately, and of incurring the risk of error from mistakes in reading off the indications of the dynamometer.

I prepared accordingly, a spar, or yoke, of sixteen feet eight inches long, which was divided into one hundred parts of two inches each; a small eye bolt was fixed at each extremity, and a shifting hasp fitted to the middle part. With this yoke all the experiments were made by the two following processes:—First, a model was attached by a slender towing line to each eye bolt, and the hasp was fixed exactly in the middle of the yoke, and linked to an outrigger on the steam vessel, which was then set in motion at the required speed. If it was found that one of the models preceded the other, in consequence of its offering less resistance, the hasp was shifted along the spar towards the sluggish one, until the resistances were balanced, and the two models ran abreast of one another. The relative lengths of the arms of the yoke then gave an inverse measure of the comparative resistances of the models, *at that* rate of speed; this being noted down, the hasp was brought again to the middle of the yoke, and the model which showed least resistance, was by degrees loaded with weights, until it again exactly balanced the other, and swam abreast of it, the amount of the added weights being likewise noted, afforded a second measure of the difference of the resistance of the two models.

Each of these forms of the experiment was gone through with different pairs of the models, and was frequently repeated through long spaces of the canal, as it was found that various circumstances interfered to render the resistances inconstant, such as approaching nearer to the one or the other side of the canal, passing a loaded vessel, or making a turn round a projecting part of the bank.

It was at first attempted to conduct the experiments by towing the models astern; but it was immediately found that the ripple of the wake of the steamer disturbed the uniformity of the resistance of the models. Various modifications were then tried with more satisfactory results, and finally, the arrangement was made as follows: a spar, like a bowsprit, of about twenty feet in length, was run out a little above the level of the water from the bow of the steamer, the hasp of the yoke being attached by a link to the point of this spar, the

models were in this way kept ahead of the steamer in smooth water, and were altogether undisturbed by any ripple or wave.

The accompanying tables contain the results of these trials, from which the important inference may be drawn, that there is no form which will present a minimum resistance in all circumstances; and that the form which is easiest drawn through a canal at a low velocity, does not possess the same advantages at a higher rate of speed.

By looking into the Table A, Experiment first, we see that, although the resistance of No. 1 be to that of No. 2 as 13 to 12, when the velocity is three miles per hour, yet when the speed is increased to six miles, the advantage which No. 2 had over the flatter vessel, entirely disappears.

Again, in Table B, we see that in one experiment, No. 2 carries two-ninths more weight than No. 1, with equal resistance, when the velocity is three miles per hour; but that when the rate is raised to six miles, the loads require to be made the same in both, in order to equalize the resistance.

It appears, from numerous experiments made at intermediate speeds, that this change in the relative resistance is progressive; there is reason, therefore, to conclude, that if circumstances had admitted of carrying on the experiments at a higher velocity than six miles per hour, the flatter formed vessel would have attained a superiority over the sharper ones: this conclusion is corroborated by the fact, that the swiftest going steam vessels which have been built in this country, are those which are nearly flat in the floor for a great proportion of their whole length.

The first practical inference which may be drawn from these experiments is, that all vessels which are intended to be tracked, or impelled by machinery, through canals at low velocities, should be built as sharp in their bottoms as circumstances will admit of, although this must necessarily increase their draught of water; the second inference is, that whenever vessels are intended to move in canals with a higher rate of speed than six miles per hour, the general form of the bottom should be nearly flat.

TABLE A.
Experiments with Equal Loads.

Models tried.	United Weights of Vessel and Load.	Divisions in the arms of Yoke when at 3 Miles per hour.	Difference.	Divisions in the arms of Yoke when at 6 Miles per hour.	Difference.
Flat Vessel and Coaster, Nos. 1 and 2	192 each	(No. 1) 48 (No. 2) 52	4 div. or 1-12	(No. 1) 50 (No. 2) 50	None.
ditto	256 do.	46 54	8 div. or 1-6	50 50	ditto.
ditto	320 do.	47 53	6 div. or 1-8	49½ 50½	2-100 parts.
ditto	392 do.	45 55	10 div. or* 1-5	49 51½	2 div. or 1-24.
Flat Vessel and Schooner, Nos. 1 and 3	192 do.	(No. 1) 45 (No. 3) 55	10 div. or* 1-5	(No. 1) 50 (No. 3) 50	— —
ditto	256 do.	43 57	14 div. or 1-3	50 50	— —
ditto	320 do.	44 56	12 div. or 1-4	Uncertain.	— —
ditto	392 do.	45 55	10 div. or* 1-5	49 51	2 div. or 1-24.
Flat Vessel and Twin do., Nos. 1 and 4	256 do.	(No. 1) 50 (No. 4) 50	0 0	Uncertain.	— —
ditto	320 do.	53 47	6 div. or 1-8	ditto	— —
ditto	392 do.	52 48	4 div. or 1-12	ditto	— —

In favour of No. 1.

TABLE B.

Experiments with Equal Arms of the Yoke at three Miles per hour.

Models compared.	Depth of Immersion in Inches.	Weight of Vessels with their Loads.	Difference.	
Flat Vessel, No. 1	4.91	256 lbs. }	32	No. 2 carries 1-8th more than No. 1.
Coaster, No. 2	8.5	288 — }		
No. 1	6.083	320 — }	72	No. 2 carries 2-9ths more than No. 1.
No. 2	10.083	392 — }		
Flat Vessel, No. 1	4.17	192 — }	42	No. 3 carries 2-9ths more than No. 1.
Schooner, No. 3	8.41	234 — }		
No. 1	5.75	320 — }	42	No. 3 carries 2-15ths more than No. 1.
No. 3	10.25	362 — }		
Flat Vessel, No. 1	4.17	256 — }	0	No difference at this rate of speed.
Twin do. No. 4	4	256 — }		

N. B. The depth of immersion entered above, is that observed when the vessels were at rest, and which did not appear to alter when in motion.

TABLE C.

Experiments with equal Arms of the Yoke at six Miles per hour.

Models compared.	Immersion in inches.	Weight of Models when loaded	Difference.	
No. 1 Flat Vessel No. 2 Coaster	4 2-12 6 4-12	192 lbs. } 192 — }		The draught of water noted in the column of immersions was that observed when the models were at rest previous to the commencement of each experiment; the actual immersion during the experiment was considerably less, especially in the flatter vessels, but there were no means of ascertaining it precisely.
No. 1 No. 2	4 11-12 8 1-12	256 — } 256 — }		
No. 1 No. 3 Schr. shape	4 2-12 7 9-12	192 — } 192 — }	—	
No. 1 No. 3	4 11-12 9 2-12	256 — } 256 — }	—	
No. 1 No. 4 Twin Boat	5 9-12 5 7-12	320 — } 320 — }	—	

¶ *Account of the Depths of Mines.* By JOHN TAYLOR, F. R. S., &c.

Mr. Taylor exhibited a section, showing the depths of shafts of the deepest mines in the world, and their position in relation to the level of the sea.

The absolute depths of the principal ones were:

	Feet.
1. The shaft called Roehrobichel, at the Kitspühl mine in the Tyrol	2764
2. At the Sampson mine, at Andreasberg, in the Harz	2230

	Feet.
3. At the Valenciana mine, at Guanaxuato, Mexico	1770
4. Pearce's shaft, at the Consolidated mines, Cornwall	1464
5. At Wheal Abraham mine, Cornwall	1452
6. At Dolcoath mine, Cornwall	1410
7. At Ecton mine, Staffordshire	1380
8. Woolf's shaft, at the Consolidated mines	1350

These mines are, however, very differently situated with regard to their distance from the centre of the earth, as the last on the list, Woolf's shaft, at the Consolidated mines, has 1230 feet of its depth below the surface of the sea, while the bottom of the shaft of Valenciana, in Mexico, is near 6000 feet in absolute height above the tops of the shafts in Cornwall. The bottom of the shaft at the Sampson mine, in the Harz, is but a few fathoms under the level of the ocean; and this, and the deep mine of Kitspühl, form, therefore, intermediate links between those of Mexico and Cornwall.

Mr. Taylor stated, that taking the diameter of the earth at 8000 miles, and the greatest depth under the surface of the sea being 1230 feet, or about one-fourth of a mile, it follows that we have only penetrated to the extent of $\frac{1}{32000}$ th part of the earth's diameter.

Some account was then given of the mines to which the shafts referred to belong.

Of the deepest, at Kitspühl, as it has long ceased to work, we do not know much. Villefosse, in his great work on the *Richesse Minérale de l'Europe*, states that this was a copper mine, which passed for being the deepest in Europe; and that in 1759, it was reported on, amongst other mines, by MM. Jars and Duhamel, and it was then proposed to abandon the working, the water having been already suffered to rise near 200 fathoms.

The Sampson mine, in the Harz, is one of the most celebrated in that district: it has been working since the middle of the sixteenth century, and produces silver ores of superior quality. The principal shaft is sunk about six feet deeper every year, by which ground enough is drained for a regular extraction of the ores. The mine is one of the oldest in Germany, and has always been profitable: it employs from 400 to 500 men. It is the property of shareholders, who are very numerous, the interest having been much subdivided in the course of time.

The mine of Valenciana, at Guanaxuato, was one of the most renowned in Mexico. It produced annually, about the end of the last century, 360,000 ounces of silver, worth about £600,000 sterling, and then employed 3100 persons. The shaft referred to in the section, was commenced in 1791, the mine having been long previously worked by other shafts: it had attained its present depth in 1809, when the mine was stopped by the revolution. It is octagonal, and more than thirty feet in diameter, a great part of its depth being walled with beautiful masonry, and is probably the most magnificent work of the kind. The expense of forming this shaft is estimated by Humboldt at the enormous sum of £220,000. The mine was so little troubled with water, that it was considered almost a dry one:

during the suspension of the works, it, however, gradually filled. In 1825, one of the English companies undertook to drain it, which was, after great labour and expense, accomplished; but the mine has not been sufficiently productive since to make it worth while to continue the working.

The Consolidated mines form the most extensive concern in Cornwall, embracing what were formerly several distinct mines, which, as the name indicates, were connected in one undertaking.

This was arranged in 1818, and the mines which had remained unwrought for many years, were drained by very powerful steam engines, and were put into a state of active working. The management was confided to Mr. Taylor and the late Capt. William Davey: an outlay of £73,000 was incurred, which has since been repaid with ample profit. The present produce is 20,000 tons of ore a year, yielding about 1920 tons of fine copper, being one-seventh of the whole quantity raised in Great Britain. The mines employ about 2400 persons, of whom about 1400 are miners, working underground. The water raised to the adit level is about 2000 gallons per minute: the height to which this is lifted is more than 220 fathoms, or 1320 feet; the aggregate weight of the columns of water in the pumps being 512,000 pounds, or about 230 tons, and the whole is put in motion by eight immense steam engines, four of which are the largest ever made.

The depth of the mines has been increased 100 fathoms since the period of the drainage being completed, being at the rate of about eight fathoms a year.

There are, in the whole concern, ninety-five shafts, besides other perpendicular communications from level to level underground, called winzes. The depths of the whole added together, make up about 22,000 fathoms, or twenty-five miles; and the levels, or galleries, will make up, in horizontal distance, a length of 38,000 fathoms, or about forty-three miles.

Wheal Abraham is an old copper mine, the working of which was abandoned a few years since, the vein having ceased to be productive in depth. It was, until very lately, the deepest mine from the surface in Cornwall, but is now surpassed by the Consolidated mines.

Dolcoath mine was formerly called Bullen Garden, and a section of it as it was at that time, will be found in Dr. Pryce's work, *Mineralogia Cornubiensis*, published in 1778. It was then rather more than ninety fathoms deep, and probably one of the deepest mines at that time. It has, therefore, been sunk 140 fathoms since; but, like all the great mines, it has not been in constant work. It has now been actively prosecuted for many years, and at present stands third in the list of copper mines in Cornwall, arranging them according to the value of their produce. That of Dolcoath, however, does not amount to one half of that of the Consolidated mines.

Ecton mine is celebrated in most books on mineralogy, as one of the principal copper mines in England; and it was so at one period, though the produce is now inconsiderable. It is situated in Staffordshire, on the borders of Derbyshire, and is very curious, from being

in limestone, and having no regular vein. The ore has been found in large masses, irregularly deposited, and is generally taken to be an example of contemporaneous formation. The mine has been regularly worked for a long series of years, and is now nearly exhausted. It is the property of the Duke of Devonshire, and very large profits were given by it in the latter part of the last century, some of which, it is said, were applied by the late Duke to the erection of the beautiful Crescent at Buxton. The mine is not far distant from this place, and is in a very picturesque situation on the banks of the river Manifold.

Mr. Taylor gave some account of the extent to which steam power is at present employed in Cornwall in draining the mines which penetrate so far beneath the level of the sea, showing the influence that the great improvements, which have from time to time been made, and many of them even recently, must have upon the production of some of the most useful metals.

The number of steam engines used in pumping water from the mines in Cornwall, in December, 1832, was altogether sixty-four.

Some of these are of immense size and power: there are five in the county, of which the diameter of the cylinder is ninety inches, the pistons making a stroke of ten feet. Four of these are at the Consolidated mines, and the first constructed of this size, was planned and erected there by Mr. Woolf. The beam of such an engine weighs twenty-seven tons; the pump rods are of mast timber, sixteen inches square, connected by iron strapping plates, of enormous weight. The column of water lifted, the rods and beam, make up a weight of more than 100 tons, and this is kept in motion at the rate of from five to ten strokes per minute.

The quantity of coal consumed in drawing water in the same month, in all the mines of Cornwall, was 84,034 bushels, and the quantity of water delivered, about 19,279 gallons per minute. The weight of water actually poised by all these engines to produce this effect, amounts to about 1137 tons.

From calculations carefully made in Mexico, as to horse power employed in draining mines, and deduced from a large scale of operations, it is found that the performance is equal to 19,000 pounds raised one foot high per minute for each horse.

According to this rate, the coal consumed in Cornwall in a month, being 84,000 bushels, or 2800 per day, and taking the duty of the engines at 55,000,000 pounds lifted one foot by each bushel, which is very nearly the fact, it will be found that the sixteenth part of a bushel does as much in raising water in Cornwall, as a horse does in Mexico, (working three hours out of twenty-four,) and that thus the number of horses required to drain the mines of Cornwall would be 44,800.

[*Rep. 3d Meeting Brit. Associa.*]

¶ *Remarks on the Protection of Copper Sheathing upon Ships' Bottoms.* By G. G. BOMPAS.

It is a well known fact, that when dissimilar metals are placed in

contact in a saline, or acid, solution, such as sea-water, they have an electric action upon each other, becoming on the one part positively, and on the other negatively, electrified; the effect of which is destructive of the positive metal. This has been too little regarded in the sheathing of vessels.*

The various metals and alloys employed in the building and sheathing of a ship, almost always stand in this electric relation of positive and negative to each other; and if, as is generally the case, the copper sheathing is the positive metal, it will be destroyed with a rapidity proportionate to the degree in which the electric action is excited.

The sheathing nails in common use are prepared of metals in very various proportions, regard being chiefly had to their colour and tenacity; and an examination of several specimens has proved them to be as various in their electric relations with copper, as in their composition. They are generally negative to the copper, and, consequently, promote its corrosion. Numerous experiments have proved that the galvanic action, induced by the contact of such metals, is necessarily destructive of the positive metal; and they satisfactorily explain the irregular duration, and frequently rapid destruction, of the copper sheathing, which is often erroneously ascribed solely to impurity in the copper. If the sheathing of vessels returned from a voyage be examined, the hollows made by the heads of the nails will generally be found filled with crystals of the salts of copper, and the copper itself is often completely corroded through. In an experiment, where copper obtained from H. M.'s dock-yard was employed, and to avoid all error, each sheet was divided in half, one-half being nailed to a board with pure copper nails, and the other with different samples of the nails in actual use at different dock-yards; after ten weeks' immersion in the sea at Portsmouth harbour, one half-sheet had lost two hundred and ninety-three grains more than its fellow, a second had lost thirty-two grains more than its fellow, and a third had lost twenty grains more than its fellow half-sheet: but one with nails prepared on the principles recommended in this paper, had lost thirty-four grains *less* than its fellow half-sheet. It is fair to presume that, if sheathing nails similar to the samples had been used with the same copper on a ship, the duration of the sheathing would have been in somewhat the same proportion.

Copper possesses great advantages over the various alloys introduced for sheathing, from its flexibility and toughness, by which it

* At this very time, an experiment is making in France, by sheathing one-half of a ship's bottom with *cuivre bronzé*, a metal negative to copper, and the other half with copper, the metals being in contact. It is easy to foresee that the positive metal, the copper, will lose more by corrosion than the negative metal, and thus give an apparent, but deceptive, advantage to the *cuivre bronzé*. In one such an experiment already tried, the results of which have been published, the copper had, in fact, sustained more than what would be its *average* loss, when not connected with the *cuivre bronzé*. In all experiments on new metallic sheathings, there should be no *metallic* communication between the metal to be tried, and any other.

can be applied with facility, and yields to the strain of the vessel, while, by the slow solution of its surface, it very considerably diminishes the foulness from attachment of marine vegetables and animals. The chief objections to it are, its expense—the liability to corrosion, and consequent irregularity and uncertainty of its duration—and its being too soft to be used for nails, without an admixture of such other metals as generally render them negative to, and destructive of, the copper. But it is equally an objection to the other metals and alloys, that they cannot at the same time be sufficiently soft for sheathing, and yet hard enough to drive as nails. These disadvantages may, however, be almost entirely obviated by the plan now proposed.

First, by the use of sheathing nails that shall be compounded of such metals, in such proportions, as are known not to exercise any destructive agency on the sheathing, but, on the contrary, have a tendency to preserve it.

Secondly, by attaching to the sheathing a metal positive to it, which, while itself in the process of being destroyed, shall preserve the sheathing from corrosion. For it is evident that if, when several metals are placed in communication with each other, the most positive will be destroyed, and the others preserved, the application to the sheathing of a more positive metal, or compound, will thus be a protection to it. It is also obvious that the positive metal may easily be so applied, as that its destruction shall in no degree impair the strength of the vessel, or render necessary any general or expensive repairs.

Upon this principle, (the correctness of which he fully established,) Sir Humphry Davy applied masses of zinc, or of iron, of different proportionate surfaces, to the copper to be protected. The result was, that a very strong electric action was excited, and the corrosion and waste of the copper almost entirely prevented. But he found the electric energy so intense, if the protecting metal was in a large proportion, that the copper, by the decomposition of the sea-water, very speedily became covered with an earthy accretion, to which animals and plants adhered; and the sheathing became so foul as materially to impede the ship's progress. On the other hand, if a small proportion of the protecting metal were employed, it was destroyed so rapidly, that the duration of the protection was too short to be of any value. These difficulties induced him to abandon his experiments.

The difficulties which frustrated the attempts of that eminent philosopher, have been completely removed by the employment of a compound metal, which differs much less from the copper in its electric relation, than either iron or zinc. By the use of such a compound, in which the proportions of metals may be varied as required, a larger protecting mass may be employed, a more diffused and uniform electric action produced over the whole surface of the sheathing, and just that protection afforded which shall preserve it from corrosion, without causing foulness.

The protecting metal should be attached upon the sheathing in a

longitudinal belt, or band, a few inches wide, according to the size of the vessel, from stem to stern, about the light water line; and in large vessels, an additional band should be attached to the keel. Being in the direction of the passage of the vessel through the water, it will not impede her sailing; if destroyed, it will not injure the ship; and, when necessary, it can be easily removed, and renewed, without disturbing the sheathing.

After repeated and most satisfactory experiments at Portsmouth, under the inspection of the officers of H. M.'s dock-yard, the Lords Commissioners of the Admiralty were pleased to direct that the sheathing of H. M.'s schooner *Fair Rosamond* should be protected on this plan, preparatory to her sailing for the coast of Africa, where she is now stationed. She was commissioned in May, 1833, and sailed first to Oporto, and afterwards to Africa. No official report has yet been received; but in November, 1833, her copper is stated on undoubted authority, to have been clean and bright, and by subsequent accounts, it is proved to have continued so, up to the end of March, 1834.

On the whole, it has been proved that, by the adoption of the sheathing nails and protectors, the duration of the copper will be very much extended, and rendered comparatively certain; that such instances of its rapid destruction, as now so frequently occur, will be entirely prevented; and that, so far from the protectors being the cause of foulness, the sheathing will be preserved much more clean and bright than under ordinary circumstances.

Iron, and other metals, or alloys, exposed to sea-water, or acids, whether as iron cables, sheathing, or any other form, may be preserved from rust, or corrosion, on the same principle.

[*Lond. Journ.*

¶ *Detection of Adulterations in Flour.*

M. Dubuc, senior, of Rouen, has applied himself with success to the detection of farinaceous mixtures in wheaten flour. The principal substances with which flour is adulterated, are potato starch, a fecula; beans, barley, chalk, plaster of Paris, &c. An extract from his memoir is published in the last Bulletin of the Society of Encouragement, from which the following is taken.

There are two methods of detecting adulterated flour—mechanical and chemical. In France, the adulteration is principally with potato starch, as it renders the bread whiter and heavier. If there be more than ten per cent. of potato starch, it may be detected by the naked eye, or with the aid of a magnifying glass; the fecula is whiter, the particles are angular, and reflect the rays of light, like minute crystals. To render the discovery more easy, M. Dubuc dries the suspected flour in a sand bath, at 100° to 110° of Fahrenheit; and then, with a good magnifying glass, so small an adulteration as five per cent. may easily be detected.

But if the miller has been cunning enough to grind the potato starch with the wheat, other means of detection must be had recourse to.

The first is, from the great difference between the specific gravities of wheat flour, and potato starch.

The second is, that flour contains a certain per centage of *gluten*, and the starch does not contain an atom of gluten.

First Method.—A vessel that will contain one pound of flour, gently pressed down, will contain a pound and a half of *fecula*; from these data, the relative proportions of flour and *fecula*, in any parcel of flour, may be easily ascertained, very near the truth.

Second Method.—The best flour contains about twenty per cent. of gluten, and, as we have stated, the starch not an atom.

Experiment.—Take five ounces of pure wheat flour, and two ounces and a half of warm water; mix and work it well for about ten minutes; the paste will be firm and elastic. Let a little warm water fall continually upon it, while you continue to knead it; by this means, all the starch and saccharine mucilage will be extracted. The operation is finished when the water flowing from it ceases to be white; what remains is gluten, the weight of which will be about one ounce. If the flour be adulterated, the paste will be more liquid, less cohesive, and less elastic; and an intelligent baker will soon be able to discover to what extent the flour has been adulterated, from the appearance of the paste, &c.

Such are the mechanical means that may be employed with success.

Employment of Chemical Agents to discover Frauds in Flour.—It will be well to bear in mind that wheat flour is an animalised azotic matter, (*matière animalisé azotée*,) and that, on the contrary, *fecula*, or the starch extracted, pure from cereals, is entirely of a vegetable nature; from this difference, results the varied effects of the re-agents employed.

The three chemical tests which have been found best for general use, are nitric and muriatic acid, and the liquid nitrate of mercury, (*deuto nitrate*.) Their chemical effects on flour and *fecula* are as follows:

1st. Nitric acid has the property of colouring wheat flour of a fine orange yellow, whereas it neither affects the colour of *fecula* nor starch.

2d. Pure muriatic acid colours good wheat flour of a deep violet, but dissolves *fecula* and starch, and forms with it a light, colourless, viscous fluid, decomposable by alkalies.

Experiments with Nitric Acid of forty.—Take 100 grains of pure wheat flour, pour on it 100 grains of nitric acid, (*aquafortis*,) in a small earthen or china cup, stirring it with a glass tube, it will heat a little, and in a few hours it will change colour, from yellow to a fine orange colour.

Take 100 grains of *fecula*, and pour on it 100 grains of nitric acid; heat it in every respect the same as above, but no caloric will be evolved, and the mixture will not change colour.

Take of flour 80 grains, and of fecula 20 grains, and of acid 100 grains; mix well; the colour will now be much paler, and of a light citron colour. Take 50 grains of flour, and 50 grains of fecula, and 100 grains of acid; mix well: the colour is now much paler than before, so that, with a little practice, the quantity of fecula may be detected by the greater or less intensity of colours.

Experiments with Muriatic Acid of twenty-one degrees of strength.—Take of wheat flour and acid, each 100 grains; mix well; the colour will become at first red, then violet, and finish by becoming of a beautiful indigo colour. This operation is accelerated, if a gentle heat be applied.

Take 100 grains of fecula, and 100 grains of acid; the mixture is at first of the consistence of paste, and then becomes liquid; the fecula is dissolved, and the solution *colourless*.

On varying the proportions of flour and fecula, we shall soon be able to ascertain the quantity of fecula in a sample of suspected flour.

Experiment in the liquid Nitrate of Mercury.—Take of flour and nitrate, each 100 grains; mix well with a glass tube, or rod. The paste will at first be of a pale citron, then reddish, and in three hours will become a full red. The colour is permanent.

Take 100 grains each of fecula and nitrate; they will not combine, nor will the colour of the fecula, or starch, be acted upon.

By mixing flour and fecula in different proportions, and observing the colours, we may soon be able to detect the proportions in which flour is adulterated by fecula, or starch.

It may also be observed, that fecula absorbs less water than flour, which affords a ready means of detection.

The adulteration with bean, or pea flour, may be detected by pouring boiling water upon it, which develops the peculiar smell of these two substances.

We may add, that the adulteration with chalk, or gypsum, may be detected by pouring a diluted acid on the suspected flour, as an effervescence will take place, and carbonic acid gas be disengaged.

[*lb.*

¶ *Remarks on Sugar Refining, and on Dr. Ure's Experiments.*

There is scarcely any branch of domestic industry which has stronger claims to the attention of our Government than the sugar refinery of this country. As a branch of our colonial trade, it is of great importance; as a manufacture continually advancing upon principles of scientific improvement, its details and operations have for some years past attracted much public attention. The insertion of the whole of Dr. Ure's experiments and long report in this journal, attest the interest which men of science attach to the process, and will be my excuse for some detailed observations upon those experiments. They were made by direction of the Board of Trade, for the purpose of correctly ascertaining the quantity of refined sugar

and extracts which could be produced from one hundred weight of raw or clayed sugar, in order to enable the Government to adjust in an equitable manner, the amount of drawback which should be allowed as an equivalent to the amount of duty paid upon the hundred weight of colonial sugar.

The refiners, as a body, have been naturally indisposed to state the maximum quantity of refined produce from the hundred weight of raw material, not because they would throw a small additional drawback into the exporter's hands, but because the maximum produce is continually varying, according to various improvements adopted by the several refiners; and because the details of the refinery as to what quantity shall be produced in the course of continued operations, from the hundred weight of raw, must necessarily depend upon the judgment each refiner entertains of the relative state of the home, including the export, market, with the raw sugar market,—which judgment must guide him as to the conversion of the great bulk of his inferior sirops into sugar that shall be just entitled to the bounty, or into Basseterre, commonly called bastard, of which little or none is exported, and into treacle, which claims no drawback. Dr. Ure has communicated so many of the arcana of the sugar refinery in his report, that I may be allowed to add the single secret upon which the whole process mainly rests as to profit or loss, the grand object of concern at the close of this very complicated manufacture. These preliminary observations are necessary to the clear apprehension of the effect and consequences induced by the various scientific improvements made of late years in the production of refined sugar. The principal of these improvements may be stated to be Dr. Howard's invention of boiling the sirops in *vacuo*, and the almost simultaneous use of animal charcoal; vegetable charcoal had been used for some time previous to the introduction of animal charcoal. Scientific readers need not be informed that the effect of boiling the sirops in *vacuo* must be the production of a larger proportionate quantity of refined extract than can be procured under the open pan process, which, by the intensity of the fire under the pan, carbonizes, to a certain extent, the sirop subjected to this operation. But men of science are not generally aware that sugar produced in the low temperature of the vacuum pan, or of bath pans, will not stand the action of sea-damp in a long voyage, in any thing like the degree that open pan refined sugar will. The exporters are fully aware of this fact. Dr. Ure found that "damage was done by slow evaporation;" page 140; and his first "loaves were not only porous, but so devoid of cohesion, that, falling into powder, they had to be worked up again."—Vide p. 140, and Table I., p. 205.

Howard's process of boiling in *vacuo* is, however, an important and beneficial discovery; it undoubtedly produces a larger quantity of refined sugar, of a superior quality as to whiteness and brilliancy; and the public, by means of this and other improvements, have their finer sugars cheaper. The superior advantages derived from these improvements, relate, also, to the quantities more rapidly turned into the market. But I am decidedly of opinion that a given quantity of

Howard's patent sugar does not sweeten to the extent that open pan sugar of the same or inferior complexion does; nor will it, I apprehend, give, after fermentation, an equal quantity of alcohol by distillation: which alone indicates the relative quantity of saccharine principle, or matter, contained in any given quantities of sugar, either raw or refined. Upon the subject of vacuum refining, I may just observe, that the original cost of the steam engine, and the apparatus generally, is excessive. It is highly probable, that, notwithstanding the superior quantity and quality of the produce, the invention has only benefitted those who have held and licensed out the patent—not the refiners who have used it: several of the largest vacuum refineries have failed, or have ceased their operations. Indeed, I believe, that, notwithstanding the aid of Government, and the “artifices,” as Dr. Ure has it, of the refiners, sugar has been transmitted into its refined state, for a series of years, *pro bono publico*. The expenses of a refinery are so enormous and various, that it requires the greatest discrimination in the choice and purchase of the raw material, united to the most matured and sound judgment in the arrangement of the complicated details of the process, to insure the mere common interest upon the capital employed. [*Ibid.*]

¶ *Simple Mode of Extracting the Wax from Honeycombs.*

Sir,—As the season is approaching in which cottagers and apiarists generally commence their operations on the product of their beehives, I think you will confer an obligation on many of your readers of that class, by disseminating amongst them the following most simple and efficient method of extracting the wax from the combs.

Get a bag made of coarse hempen cloth, such as safe cloth, or strong cheese cloth, either of which will do—its size to be determined by the quantity to be operated upon. Break up the combs so as to occupy as small a space as possible. Tie the bag close, and to its mouth and each corner attach weights of sufficient preponderance to sink the bag and its contents to the bottom of the water in the boiler, and retain it there. Regulate your fire so that the water shall boil steadily; the wax will speedily find its way to the surface, not unlike the fat in culinary processes, and may as easily be skimmed off into a milk pan, or some other vessel of sufficient diameter. If some water be taken up with it, it is of no consequence. Then provide a smooth blunt staff, and press and work the bag as it lies on the bottom of the boiler, until it will yield no more. If you then raise up the bag, and discharge its contents, you will find the residuum a mere mass of dirt, with not a particle of wax remaining. This no one will be surprised at, if they give this very simple process but a moment's consideration. Indeed, the results of this method are so very obvious, that I can scarcely flatter myself the same idea may not have occurred to others; but, as far as I am aware, it originated entirely with myself. I have practised it for at least forty years past. I have kept bees forty-seven years; and finding the dif-

ferent processes in use for extracting the wax, were most wasteful and troublesome, I at last hit upon this expedient, when every difficulty vanished in a moment, I have not failed to impart it to others, as far as my circle extends; still, I am certain it is far from being generally known.

To bear me out in this assertion, I need only observe, that I have read every treatise on bees worth notice, even down to Mr. Nutt; yet neither Mr. Nutt, nor any of the older authors, have struck out any new light to direct us through this hitherto filthy and wasteful process. It would provoke the risible muscles of your readers, were I to describe the various operose and unscientific methods (even now in use) to effect it, such as submitting the bag (drawn out of boiling water) to the action of a cheese press, or with some, (who have not that convenience) holding the bag suspended whilst an assistant compresses it with a pair of tongs, at a risk of scalding the whole party, &c. &c. On completing my first process, the wax is immediately ready for melting down into any form you like. Should any person wish to melt his brightest and clearest combs by themselves, this he may readily do, and make a second immersion with the fouler combs; but I have always done it at once, by melting down the skimmed wax, and pouring it into a pan or basin adapted to its quantity (having previously wetted its inside with cold water, to prevent adhesion,) and then covering it up warm, that it may cool gradually; after which the inferior wax (at the bottom) may be cut off, melted, and poured into any small receptacle, for the use of the family.

Yours, &c.

August 13, 1834.

WILLIAM DUMMETT.

[*Lond. Mech. Mag.*]

¶ *The Refractive Powers of the Atmosphere, a Frequent Source of Error in Surveying.*

INSTITUTION OF CIVIL ENGINEERS, APRIL 15.—“A conversation was held on the refractive quality of the atmosphere as affecting the taking of levels—an extract from the Memoir of the late Captain Joseph Huddart, relating to the subject, having been previously read. Captain Huddart had frequently remarked that low lands, and the extremities of head lands, forming an acute angle with the horizon when viewed at a distance, appeared elevated above the horizon, with an open space between the land and the sea. These appearances he considered to arise from, and be in proportion to, the evaporation going on at the time, and felt convinced they were caused by evaporation; and that, instead of the refraction of the atmosphere increasing to the surface of the sea, it must decrease towards it from some elevated space; and that the principal cause which prevents the uniformity of density and refraction being continued, by the general law, down to the surface, is evaporation. A member concluded, from the above statements, that the maximum of refraction was at the point most elevated from the surface to which evaporation extends, and

consequently that a person should be guarded in taking levels when elevated from the surface of a marsh, or body of water, during the process of evaporation. A member had frequently observed objects across the Thames come into view on the rise of the tide, which, at low water, were hidden by the intervening land; this he attributed entirely to refraction, and considered that levels across a body of water should be taken as near the surface as possible. It was observed that this phenomenon was probably caused by the greater width of refractive medium; also, that long sights were to be avoided in taking levels after heavy rains; and that in levelling across a stream, more accuracy would be attained by assuming the height of water equal at both sides, than by taking a sight with a spirit level." *Athenæum*. [Ibid.]

¶ Straw Paper.

"The great price which rags acquired some few years since, in consequence of the great increase of printing and the paper trade, induced many ingenious men to turn their attention to discover other materials for making paper. A very large manufactory was established some years ago, in London, for making straw paper at Millbank, by the river side; but the scheme proved abortive, and the premises were lately disposed of.

"In 1802, Mr. Matthias Koop invented the following method of making straw paper, for which he obtained a patent. For each pound of straw, or hay, a pound, or a pound and a half, of quicklime is to be dissolved in about a gallon or six quarts of river water.

"The hay, or straw, is to be cut into portions about two inches in length, then boiled in a considerable quantity of water, viz: about two gallons to a pound of materials, for three-quarters of an hour. It is then to be macerated in the solution of lime and water, for five, six, seven, or more days, taking care to agitate the mass by frequently stirring and turning it over. At the end of this time, the lime water is to be drawn off, and the materials to be washed very clean, then boiled in a large portion of clean river water. This part of the operation is to be repeated, and, for the sake of improving the colour of the paper, one pound of dissolved crystal of soda, or potash, may be used to every thirty-six pounds of straw, or hay.

"When the materials are pressed out of the water, the manufacture of them into paper, may be proceeded with by the usual and well known processes. In some cases, the patentee has thought it advisable to suffer the materials to ferment and heat before they were reduced to a pulp, as was formerly the case with the rags for paper making. This, however, will always depend upon the warmth of the Season.

"When thistles are used, they are to be cut down when the bloom begins to fall, to be dried and reduced into lengths of two inches; and then the same process to be made use of, as has been already described with regard to the straw and hay."—*Hansard's Typog.* [Ibid.]

¶ *The Russian Platina Mines.*

A report has recently appeared, in the Berlin State Gazette, upon the production of platina, and the present state of the mines of that metal in the Russian empire. During ten years, from midsummer, 1824, to January, 1834, the quantity of platina ore extracted from the mines in the Ural mountains, amounted to 230 quintals, which yielded upwards of two-thirds of pure metal. Of this, about 153 quintals were coined, amounting to a sum of 8,186,620 roubles. About 160 pounds were employed in the manufacture of vessels for the separation of gold from silver, and for other purposes. Estimating the amount coined as below one million sterling, and this product of the mines being spread over a period of ten years, it would appear that beyond the cost of the establishments, but little clear revenue has been derived from the mines. But as they are the exclusive property of the crown, and worked by serfs, whose maintenance may be estimated at the minimum of the cost of human support—and moreover, as the quantity of ore has progressively increased with the progress of the mining operations, it is by no means to be supposed that the Ural mines may not add, in a very considerable degree, to the wealth of the Russian empire. Platina being a metal of great unimpressibility, much difficulty was experienced in first converting it into coin; but at length a die of the most ingenious description was constructed for the purpose, by a French mechanist, who is said to have received a very large reward. The coin has hitherto preserved an exact mean between the value of gold and silver; but how its future value may be changed by the increased supply of the ore, and its comparative intrinsic utility for other purposes than money, is yet to be determined. The coin is a handsome one, and specimens, we believe, may be seen at the British Museum.

[*Ibid.*

¶ *Manual Labour and Mental Cultivation.*

“My conviction—not lightly taken up, but the result of long and earnest thought—is, that daily occupation with manual labour is in no way incompatible with the highest mental cultivation and refinement; that, so far from the exercise of mechanical employment daily, for a moderate time, being detrimental to the mental powers, it has, on the contrary, a decided tendency to strengthen them; and that, if those who at present serve the public in the capacity of writers, were to employ several hours a day in mechanical labour, their bodily health would be improved, and their writings would take a character of vigour startling even to themselves. They would find the workshop a more healthy atmosphere than the drawing room. There is no reason, save ignorance, why any thing like degradation should attach to the character of the working mechanics. There is no reason, save ignorance, why they should not have dwellings as good as

their employers, as to all the purposes of comfort. There is no reason, save ignorance, why they should not have refreshing baths after their daily toil, and abundant change of comely garments conducive to health. There is no reason, save ignorance, why they should not have abundance of good and well-prepared food for the body, and access to books of all kinds for the proper culture of the mind. There is no reason, save ignorance, why they should not have access to theatres, and operas, and lectures of all kinds, and picture and sculpture galleries, and museums, far more imposing than any thing the world has yet beheld. There is no reason, save ignorance, why the great body of the working people should not possess, in addition to all that is necessary for the comfortable maintenance of the body, all the pleasures of mental refinement, which are now only within the grasp of the very rich. There is no reason, save ignorance, why the ruling power of the state should not be in their own hands, and all else, save only the excitements of ostentation, and expensive sensuality.”

[*Tait's Mag.*

¶ *Pin Heading.*

The process of pin-heading, three establishments for which I visited, is carried on in the following way: A large room is filled with small tables, at each of which sit four children, about thirty or forty together in a room, and certainly of ages lower than I should suppose it possible could be employed in any other gainful occupation. The majority of those I saw did not appear to be above seven or eight; and, in fact, the scene, as far as regards the ages of the children, reminded me more of an infant school, than any thing else I had ever witnessed. A sort of frame is fixed before each child, on which is suspended a heavy weight, which is kept in perpetual motion by the child pressing its foot on a treadle beneath the table; and the continual thumping noise of which, close to the infant's ear, seems well calculated to produce the ear-ache, complained of by several witnesses. Each child is in a position continually bent in the form of the letter C, its head being about eight inches from the table, and both its hands engaged in taking up the shanks, and putting heads on them, which heads are then tightened by blows from the weight suspended before it. On the whole, the employment of pin-heading seemed to me the most irksome and monotonous, without exception, I had ever witnessed; and knowing the cruelties that are sometimes practised at it, to keep their infants at work, I was not surprised at being told by a manufacturer, that he had been once engaged in the trade, but had left it, owing to the disgust he felt at this part of the business.—*Mr. Tuffnell's Report, Factory Commission.*

[*Lond. Mech. Mag.*

¶ *Remarks on Flame.* By Mr. J. MURRAY.

The non-transit of flame through orifices formed in *non-radiating* and *non-conducting* materials, I was the first to establish, in dis-

tinct contradiction to the universally received opinion, and none has ever advanced, so far, a fairer claim. The recent experiments of Dr. C. Williams have also fully corroborated my other views respecting flame, namely, that though it cannot be denied that there are flames which possess intense temperatures, there are other specific flames which exhibit comparatively low grades of temperature. Thus, Dr. Williams has shown that there are flames into which the finger may be introduced without suffering; therefore, the assumption that "flame, in all cases, is inflammable or gaseous matter, heated above whiteness," "and that to a degree infinitely above the white heat of solid bodies," is an error of the most palpable description. [Ib.

List of American Patents which issued in February, 1835.

	Feb.
58. <i>Straw cutter</i> .—Stephen Ustick, city of Philadelphia,	5
59. <i>Sawing staves</i> .—Hart Pepper, Southwick, Mass.	5
60. <i>Fur cutting machine</i> .—Curtis M. Sampson, city of New York,	5
61. <i>Thrashing machine</i> .—Joseph Ross, Boundbrook, New Jersey,	6
62. <i>Clover hulling</i> .—" " "	6
63. <i>Ships' windlass</i> .—Seth Adams, Boston, Mass.	6
64. <i>Cheese press</i> .—Rufus Porter, Belerica, Mass.	6
65. <i>Washing machine</i> .—Amos C. Hanniford, Northfield, New Hampshire,	6
66. <i>Auger, or bit</i> .—Ezra L'Hommedieu, Saybrook, Conn.	11
67. <i>Theodolite</i> .—James Eames, Newry, Maine,	11
68. <i>Horse rake</i> .—Noah Briggs, New Hartford, New York,	11
69. <i>Corn sheller</i> .—J. H. Taylor and A. J. Cowles, Westfield, N. Y.	11
70. <i>Plough</i> .—David Ghormley, Wayne, Ohio,	13
71. <i>Hogs, scalding</i> .—Thomas J. Godman, city of Baltimore,	13
72. <i>Furnace bake-oven</i> .—Charles E. Russell, city of Philadelphia,	13
73. <i>Plough</i> .—Nathan Robinson, Sacketts' Harbour, New York,	13
74. <i>Brad cutter, revolving</i> .—A. B. Woods, and E. Talbot, Jr., Windsor, Conn.	13
75. <i>Cotton planter</i> .—Michael Bean, Buffaloe, North Carolina,	13
76. <i>Corn sheller</i> .—E. Reed, and A. L. Norcross, Hallowell, Maine,	13
77. <i>Forge back</i> .—Isaac Sawyer, Hallowell, Maine,	13
78. <i>Brick striker</i> .—Peleg Sweet, Ashtabula, Ohio,	20
79. <i>Paper making</i> .—John Ames, Springfield, Mass.	20
80. <i>Cement for reservoirs</i> .—John C. Johnston, Catskill, New York,	20
81. <i>Rotary steam engine</i> .—George M. Alsop, city of Philadelphia,	20
82. <i>Water proof roofs</i> .—Lyman Garfield, Troy, New York,	20
83. <i>Ventilation for ships</i> .—James Barron, city of Philadelphia,	20
84. <i>Percussion lock</i> .—Robert Beale, city of Washington,	20
85. <i>Mill bush, ring, and bale</i> .—Warren P. Wing, Greenwich, Mass.	20
86. <i>Plough</i> .—Benjamin Johnston, Hickory Grove, Ill.	20
87. <i>Percussion lock</i> .—Thomas Daplyn, Dover, Delaware,	20
88. <i>Scoop shovel</i> .—J. and W. Smith, Williamstown, Mass.	25
89. <i>Chairs, &c. on rail-roads</i> .—J. M. Palisse, and S. S. Durfee, Hudson, New York,	25
90. <i>Cooking stove</i> .—Paul Wing, Grafton, Mass.	25
91. <i>Cutting meat</i> .—John Morris, Derby, Conn.	25
92. <i>Propelling wheel</i> .—Nehemiah Dodge, city of New York,	25
93. <i>Mortising machine</i> .—Grove Bradley, Auburn, New York,	25
94. <i>Potato washing machine</i> .—William Ellis, Waterville, Maine,	25
95. <i>Branding irons</i> .—E. Barns, G. Hills, and J. B. Hawkins, Ashtabula, Ohio,	25

CELESTIAL PHENOMENA, FOR MAY, 1835.
Calculated by S. C. Walker.

Day.	H'r.	Min.					
1	7	5	Im.	B Tauri,	,5,	N. 88°	V. 146°
1	8	14	Em.			268°	324°
2	7	41	Im.	4 Geminorum,	,3,	65°	123°
2	8	52	Em.			289°	345°
3	10	34	Im.	k Geminorum,	,4,	110°	163°
3	11	22	Em.			222°	273°
6	8	16	Im.	42 Leonis,	,6,	145°	173°
6	8	21	Em.			153°	181°
1	15	8	Im.	γ Libræ,	,6,	117°	156°
11	15	52	Em.			203°	247°

Meteorological Observations for January, 1835.

Moon. Days.	Therm.		Barometer.		Wind.		Water fallen in rain.	State of the weather, and Remarks.	
	Sum rise.	2 P.M.	Sum rise.	2 P.M.	Direction.	Force.			
1	94°	92°	29.90	30.05	W.	Moderate.		Clear day.	Thermometer.
2	92	91	29.80	30.05	W.	do.		Cloudy—lightly cloudy.	
3	94	91	30.10	30.30	W.	Calm.		Clear day.	Barometer.
4	92	90	30.84	30.84	NW.	do.		Clear day.	
5	95	96	30.23	30.15	W. N.	do.		Clear day.	30.30 on 24th.
6	98	106	.04	.12	NE.	Brisk.		Clear day.	
7	0	12	.90	.90	N.	Moderate.		Clear day.	29.25 on 31st.
8	1	14	.90	.90	N. SW.	do.		Clear day.	
9	0	20	.90	.94	N. N. W.	Calm.		Clear day.	29.90
10	6	26	.90	.90	N. N.	Moderate.		Clear day.	
11	90	35	.15	.14	W. SE.	do.		Clear day.	
12	17	35	.06	.03	W.	Calm.		Clear day.	
13	36	44	29.93	29.87	NW. SSW	Moderate.		lightly cloudy—hazy.	0.75
14	36	38	54	.51	W.	Calm.		Rainy day.	
15	33	46	.80	.74	W. SE.	do.		lightly cloudy—hazy—rain in n'l.	0.85
16	38	40	.44	.60	W.	Brisk.		Cloudy—flying clouds.	
17	33	37	.95	.90	W.	do.		Clear—lightly cloudy.	
18	20	34	30.00	29.95	N. NW.	Moderate.		Cloudy—clear.	
19	21	36	.00	.37	W.	do.		Clear—cloudy.	0.16
20	30	43	29.80	.85	W.	do.		Cloudy—clear	
21	32	44	.85	.65	E. SW.	do.		Cloudy—lightly cloudy; rain in n'l.	0.10
22	35	41	.42	.60	W.	Brisk.		Clear day.	
23	37	47	.70	.85	W.	do.		Clear day.	0.02
24	31	36	30.90	30.30	W.	Moderate.		lightly cloudy—cloudy.	
25	33	42	.15	29.93	SE.	do.		Cloudy—drizzle—rain.	0.11
26	43	46	29.65	.65	W. SSW.	do.		Cloudy—foggy—rain with light g.	
27	42	50	.70	.73	W.	do.		Clear—lightly cloudy—rain in n'l.	0.60
28	49	49	.60	.60	W.	Brisk.		Cloudy—flying clouds.	
29	32	43	30.10	30.15	W. SSE.	Moderate.		Clear—rain in night.	0.62
30	30	46	29.86	.70	E.	do.		Rain; foggy; rain in night, thunder	
31	40	43	.85	.35	W.	Brisk.		Cloudy—flying clouds. &c lightning	
Mean	24.87	34.77	29.90	29.91			3.21		

Maximum height during the month, 50. on 27th,
Minimum do. 5. on 5th.
Mean do. 29.82

JOURNAL
OF THE
FRANKLIN INSTITUTE
OF THE
State of Pennsylvania,
DEVOTED TO THE
MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

MAY, 1835.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Notice of the Sandy and Beaver and the Mahoning Canal.

(WITH A MAP.)

Two companies have been chartered by the Legislatures of Ohio and Pennsylvania, to construct canals to connect the western termination of Pennsylvania with the Ohio and Erie canal. A charter for the Mahoning, or northern route, was first obtained; subsequently, a charter for the southern, or Sandy and Beaver, route, was granted.

The Sandy and Beaver route commences at the mouth of the Big Beaver, twenty-eight miles below Pittsburg, and continues down the north flats of the Ohio river, to Little Beaver creek; thence it occupies the valley of that stream, till it reaches the town of New Lisbon; a short distance north of which, it ascends, by a narrow ravine, to the dividing ridge between the waters of the Beaver and Sandy; after crossing which, it continues along the valley of the Sandy, and gradually descends to its mouth, near which it intersects with the Ohio and Erie canal, at Bolivar.

The route is ninety miles in extent, and is located through an extremely rich and fertile country; the summit occupies the dividing ridge between New Lisbon, and a point west of the town of Hanover, a distance of fourteen miles; it receives the drainage of eighty square miles of country, and is to be supplied with water from Cold Run, Brush Run, and west fork of Little Beaver Creek, Sandy Creek,

Holland's Creek, Mendenhall's Run, and Davis' Branch; in addition to which, the head waters of the Mahoning can be conducted into it by means of a short feeder. These streams, at their minimum, afford sufficient water for the transit of seventeen boats per day, and, during nine months of the year, an average flow of 2,570 cubic feet of water per minute; an amount adequate to accommodate a trade of 295 boats per day: in addition to this, it is proposed to erect reservoirs, from time to time, as the business may require. Many eligible sites for this purpose are to be found contiguous to the line, four of which have been surveyed, and found to have capacity to contain 280,000,000 cubic feet of water, and would inundate 726 acres of land.

The work is to be constructed of the same dimensions as the Pennsylvania and Ohio canals; the locks, aqueducts, and bridge abutments, are to be formed of sand stone, and are intended to be of the most permanent character; the country through which the route is located, affords materials for the construction of the work, such as stone, timber, and hydraulic lime, of the best description, and in the greatest abundance; the cost of the whole work, including reservoirs, is estimated at \$1,289,000.

The Governor of Ohio, in his last annual message, mentions the Sandy and Beaver canal in the following favourable manner: "Viewing a communication between the Pennsylvania and Ohio canals to be a subject of great interest, it is with peculiar satisfaction I communicate to you the intelligence, that the Sandy and Beaver canal company was organized during the last summer, under the liberal provision of the original charter, and the munificent grant of the legislature, in an amendatory act of the last session." "By the report of two able and experienced engineers, all doubts have been removed from the public mind, as to the supply of water on the summit, and is conclusive as to the question of an abundant supply of water for all the demands of an extensive commerce." "Such a connexion has long been a desideratum to the people of the interior and southern parts of Ohio, as it will open to them a new and short route to the eastern markets for their abundant produce, and will enable the eastern and western merchants to transport goods from the east at a much earlier period of the spring, than by the New York canal."

The Mahoning, or northern route, commences at the village of Akron, on the Ohio and Erie canal, and from thence extends, in an easterly direction, to the Little Cuyahoga, at Middlebury; "from which it pursues a north-easterly course, until it approaches near the main Cuyahoga, in the township of Stow; thence continuing the same general direction along the south and south-east bank of that river, until it passes the village of Franklin, it enters the valley of the Breakneck creek, and passing up that valley in an easterly course, it crosses the summit between the waters of the Cuyahoga and Mahoning branch of the Big Beaver, near the village of Ravenna. The line then descends rapidly into the valley of the west branch of the Mahoning, crosses that stream near its south-westerly bend, continues along its north bank, recrossing that branch, and also the

south, or main branch, a mile above the junction of those streams; then leaving the river, the line pursues an easterly course, again approaching the river opposite the village of Warren," and then continues along the valley of the river, in a south-easterly direction, to the Big Beaver; thence it follows the valley of the Big Beaver, and connects with the Ohio at the town of Beaver. The whole distance from Akron to the Ohio, by this route, is about one hundred and twelve miles.

The canal commissioners of the state of Ohio, in their report on this route, propose to supply the summit level with water by the following means.

1st. By a feeder from Breakneck creek. This stream, they state, may be introduced by a feeder three miles and six chains in length, and is sufficient for the supply of the summit level, and the contiguous levels, in ordinary seasons, during more than half the year. In the driest seasons, when the flow of water is reduced to the least quantity, it yields about 240 cubic feet per minute.

2d. By forming reservoirs of four lakes, or ponds, situated near the summit. These bodies of water, Muddy Pond, Sandy Pond, Brady's Lake, and Lake Pippin, may, they state, be converted into valuable and convenient reservoirs, for the supply of the summit, and the adjacent levels; the two former will contain an area of about 240 acres. Water to the depth of twenty feet, or even more, may be accumulated in these ponds, and conducted into the canal, by means of a feeder, seventy-eight chains in length. A depth of eight or ten feet of water on the area of Brady's Lake, and Lake Pippin, may be made available to supply the canal in dry seasons.

It is computed that 325,000,000 cubic feet of water may be reserved for use in these reservoirs.

It will be perceived by the foregoing description—deduced from the reports of Major Douglass, Col. Kearney, E. H. Gill, H. Hage, and Col. Dodge, the engineers that examined the routes—that the summit of each canal has to rely on reservoirs, during a period of drought, for a supply of water. By an examination of their respective charters, it will be found that the stockholders of the northern, or Mahoning route, are permitted to receive but ten per cent. on the cost of the work in tolls, while the Sandy and Beaver canal company are allowed twenty; in addition to which, it has received from the Legislature of Ohio, the following very liberal grant, which alone, in a very few years, will much more than repay the cost of the work.

"That when the canal authorised to be constructed by the act, entitled an act to incorporate the Sandy and Beaver canal company, shall have been completed twenty miles from the Ohio canal, said company shall be entitled to collect and receive the tolls accruing on the Ohio canal, on all freight and passengers that may be transported thereon, and which have been transported not less than twenty miles on said Sandy and Beaver canal, to the Ohio canal; and to receive the toll on all freight and passengers that may be transported thereon, and discharged and landed in said Sandy and Beaver canal, at any point not less than twenty miles from the Ohio canal, for the

term of seven years from and after the completion of the twenty miles of canal aforesaid."

Viewing the two routes in point of accommodation to the trade of the west and south-west, embracing the states of Kentucky, Indiana, Illinois, Missouri, and the most fertile portion of Ohio, it will be observed that, by the Sandy and Beaver route, the distance to Pittsburgh, or Philadelphia, is *sixty-five miles less* than by the Mahoning, or northern route.

The western termination of the Sandy and Beaver canal is in $40^{\circ} 36'$, north latitude; Pittsburgh, $40^{\circ} 28'$; and Philadelphia, in $39^{\circ} 57'$. Hence, it will be perceived that the three places are nearly in a direct line. These facts portray, in the strongest light, the merits and advantages possessed by this route over any other, and that it is the most direct and desirable continuation of the Pennsylvania canal. From the western termination of the Sandy and Beaver canal, at Bolivar, the distance by the Ohio canal, Lake Erie, the New York canal, and Hudson river, to the city of New York, is 780 miles; and by the Sandy and Beaver route, and Pennsylvania improvements, to Philadelphia, 511; making a difference between these two communications to the sea-board, of 269 miles. In addition to this very decided advantage in distance in favour of the Pennsylvania and Ohio communication, is to be added, safety, economy, and despatch, and the long periods in spring and autumn which it could be used, when the lake route would be obstructed by ice, or hazardous, as is often the case, by storms.

The immense commerce that the Sandy and Beaver connexion will secure to our market, cannot at present be approached, even by conjecture. If we view the vast extent of rapidly improving country, where cities and towns are springing up as if by magic, two-thirds of the rich products of which must seek our market through this channel, some distant idea may be formed of the benefits our present chain of internal improvements, and the city of Philadelphia, are destined to derive from this communication.

As both the northern and southern route have to receive a supply of water, during a dry period, from reservoirs, the following statement may prove interesting.

Philadelphia, Dec. 29th, 1834.

SIR,—In conformity with your request, I hand you the following statement, descriptive of the merits of the summit of the Sandy and Beaver canal, compared with the Licking summit of the Ohio canal; the latter, you will perceive from the annexed letter from the present acting canal commissioner of the state of Ohio, Leander Ransom, Esq., the general accuracy of which I can vouch for, from my own personal observation, has thus far been, in a measure, entirely supplied with water by a reservoir; this reservoir covers an extent of about 2,400 acres, and, when full, has a depth of six feet above the plane of the water in the canal, and is said to contain 570,000,000 cubic feet of water; it is located on a stream which, during ordinary seasons, affords a flow of fifty cubic

feet per minute, but which, during the latter part of the last summer, was entirely dry. The reservoir receives the drainage of from thirty to forty square miles of country, and, during all portions of the year, it alone has to supply near thirty miles of the summit, and dependent levels, with water, and, during the dry season, about forty-four miles. At the period of my visit to the reservoir, which was during the driest part of the past season, there was a flow from it into the canal of 1,329 cubic feet per minute, which, at that time, was the only supply received by the summit, and its then dependent levels. The average number of boats then passing, was eight per day; to convey which across the summit, required at least an expense of twelve locks full of water per day, equal to 112 cubic feet per minute; if to this sum is added one hundred cubic feet per minute, for leakage at the locks, (which were in a very bad condition,) there will be left for evaporation and filtration on the forty-four miles supplied from the reservoir, 1,117 cubic feet per minute, or twenty-five cubic feet per mile.

This, though I shall, in the following calculations, assume it as datum, is by far too liberal an allowance, because, from measurements and observation, made by me at the time, I found that the upper level, which is nine miles in extent, and through ground of a similar character, to the summit of the Sandy and Beaver canal, but 117 feet per minute were lost by evaporation and filtration; or thirteen cubic feet per mile per minute.

The minimum natural flow of water into the summit of the Sandy and Beaver canal, during the driest period of the year, and measured during the past extremely dry season, is 558 cubic feet per minute, (though for nine months of the year it will average 2,570 cubic feet per minute;) the extent of line dependent on this supply is twenty miles, but seven of which, from the peculiarly favourable formation of the soil, and its wet and springy nature, can possibly require any allowance for leakage and evaporation. If, on this seven miles, an allowance for leakage and evaporation of twenty-five cubic feet per mile per minute is made, amounting in the aggregate to 175 feet per minute, there will still be left 383 cubic feet per minute for leakage at the locks, and the purposes of navigation; sufficient to accommodate a trade of thirty-eight boats per day, (the locks having a lift of six feet,) during the dry season, without any aid whatever from reservoirs.

No section of country is, perhaps, more favourably formed, in point of soil and topography, for the construction of numerous and large reservoirs, than that through which the summit of your proposed work is located; during my recent examinations there, sites for four were examined, having capacity to contain 280,649,600 cubic feet of water, and would receive, from actual survey, the drainage of forty-eight square miles of country. Assuming that seventy per cent. of the annual rain that falls, can be collected into reservoirs, which admits of no doubt, being within the limits of the result of actual experiment, and that thirty-six inches in depth of rain falls annually in your latitude, and the above described section of country

will afford the reservoirs a supply of 2,810,141,720 cubic feet per annum; in addition to which, the summit drains fifty-two square miles of country, fifty per cent. of which could, if required, be laid up in other reservoirs, making, in the aggregate, 4,985,164,800 cubic feet of water, upon which no demand need be made but in the dry season, or ninety days in the year.

In drawing a comparison between the Licking summit of the Ohio canal, and that of your proposed canal, it will be observed the former has an extent of forty-four miles, which is entirely dependent on the reservoir for water during the dry season; that the natural flow of water into that reservoir is but fifty cubic feet per minute, the drainage about thirty-five square miles, and the maximum depth of the reservoir is but six feet; while the latter has an extent of but twenty miles, to meet the demands of which there is a natural flow, at the driest periods of the year, of 550 cubic feet per minute; in addition to which, numerous reservoirs may be formed as required, varying from ten to thirty feet in depth, and having a surface of eighty square miles, to supply them with water.

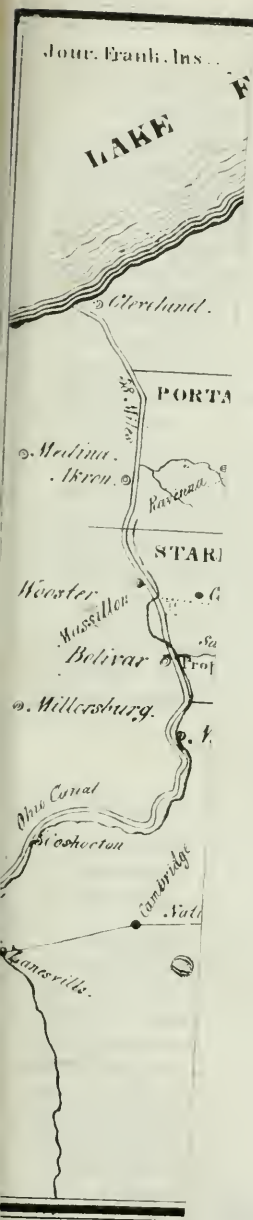
The very favourable result afforded by the Licking reservoir, may be fully anticipated from the proposed works of a similar character on the summit of the Sandy and Beaver canal; the soil and country are alike, and their proximity to each other renders each alike subject to the effect of the same changes of climate. I cannot think any other evidence than a comparison requisite to satisfy an unbiassed mind, that the supply of water that can be obtained on your proposed canal route, is far more than adequate to meet the demands that may be made on it.

But other evidence, if requisite, can be adduced in favour of the firm reliance that can be placed in reservoirs; if we look to France, there we find the Languedoc canal, supplied in a great measure from a reservoir; if we refer to England, we find the Rochdale, the Huddersfield, the Nottingham, the Oakham, the Oxford, the Dudley, the Stourbridge, and the Grand Trunk canals, the summits of most of which are entirely supplied with water by reservoirs. In Scotland, they have been found of immense advantage. In our own country, we have, in addition to the Licking and Portage summits of the Ohio canal, which are supplied by reservoirs, the summit of the Chesapeake and Delaware canal, which is, of itself, a large reservoir, and receives but a small portion of constant running water, and the summit of the Union canal. The Schuylkill Navigation Company has, during the late dry season, received great assistance from the reservoir lately erected at the head of their works.

Very respectfully, yours,

E. H. GILL,
Civil Engineer.

B. W. BAKEWELL, Esq.,
One of the Directors of the Sandy and Beaver Canal.



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Extract from a letter from Leander Ransom, Esq., Acting Ohio Canal Commissioner, in relation to the Licking Summit and Reservoir.

"The extent of country drained by the reservoir, is between thirty and forty square miles.

"The extent of line supplied in part to the westward of the reservoir, is about thirty miles in the driest part of the season; however, the water received from other sources is very inconsiderable, much depending on the duration of the drought. In the driest part of the season, nearly thirty miles to the westward, and fourteen north-east, in all forty-four miles, are supplied from the reservoir.

"The reservoir is supposed to contain, when filled to six feet above top water line of the canal, about 870,000,000 cubic feet of water, about 570,000,000 of which is available, and to cover about 2,400 acres.

"Something of an idea of the expenditure of water from the reservoir for a part of this season, may be formed from the following observations, to wit:—On the 25th of June, the water in the reservoir was 4 feet 5 inches above top water line in the canal; July 13th, 4 feet 9; August 27th, 3 feet 9; September 24th, 3 feet. No rain having fallen from July 4th, to September 24th."

Mr. Ransom states that the reservoir could have been filled much more, but it was not considered necessary; and the superintendent informed me that it could have been filled in July, had it been deemed requisite.

E. H. G.

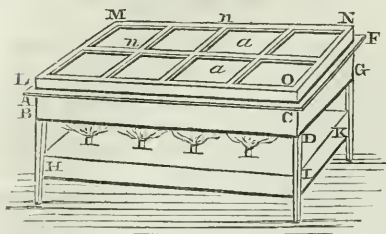
Experimental Illustrations of the Radiating and Absorbing Powers of Surfaces for Heat, of the Effects of Transparent Screens, of the Conducting Power of Solids, &c. By A. D. BACHE, Prof. of Nat. Philos. and Chemistry, University of Pennsylvania.

Among the very interesting phenomena of heat, there are many which are with difficulty brought under the eyes of a class, so as to render them satisfactory to each one, by the test of sight. The thermometer, even when constructed on a large scale, affords but an inadequate means of rendering evident the temperature of bodies, to those who are distant from the lecture table, and the illustrations made by its use are, at best, rather tame. When the temperatures to be indicated admit of it, lecturers have, in preference to using the thermometer, resorted to the freezing of water, to the melting of wax, to the inflaming of phosphorus, the boiling of water, &c., as more adequate means of rendering evident the temperatures in question.

The instruments about to be described, I have found very convenient for class illustration, and always to afford satisfactory evidence of the positions to be proved. The first instrument is intended to

show the powers of different surfaces in radiating and absorbing heat, with other phenomena, which will be referred to in the sequel.

Fig. 1.



below the box, and between the legs which support it; by this means, the top radiates heat of considerable intensity. I prefer the use of tin, in the box, to that of oil, on account of the greater cleanliness resulting from its use, and because the oil gives off an offensive smell at high temperatures. Boiling water does not give a sufficiently high temperature to produce rapid action in the apparatus, and the greater exactness with which it would yield a constant temperature, is not necessary in such an illustration.

A rectangular frame, L M N O, made of dry wood, to prevent its warping, of a small height, L A, and of a length and breadth such as to adapt it to its place upon the cover of the box, A G, is divided by cross pieces of wood into small squares, or rectangular compartments, as n n, the upper surface of the frame being perfectly plain, and parallel to the cover, A F, of the box containing the melted tin; this frame is intended to support, without the necessity of contact with each other, small plates of thin metal, or other appropriate material, the surfaces of which are variously coated.

To show the *radiating powers of different surfaces*, any convenient number of thin plates of sheet lead, or sheet tin, or mica, are cut to suit the size of the squares, n n, of the frame, overlapping the inner edges, but not extending to the middle of the small dividing bars of wood; each one of the plates has one of its surfaces differently coated; supposing them to be of lead, one is coated with lamp-black, another brightened by sand paper, or coated with tin leaf, another left tarnished, a fourth coated with gold leaf. Being placed upon the frame, as at a, a, with the coated sides uppermost, small bits of phosphorus are placed upon the middle of the plates, and the frame put in its place upon the cover, A F. The surfaces which absorb the heat radiated by the cover, A F, being the same, the material and thickness of the plates being the same, the circumstances are alike in each plate, except so far as the upper surface is concerned; the plate which is coated with the worst radiator, will become warm first, and the phosphorus will melt first upon it, and, generally, the order of melting of the phosphorus will indicate the inverse order of the radiating powers of the surfaces. As the heat radiated from the cover is high, the melting of the phosphorus will be soon followed by

its inflaming, and the order thus given will hardly deviate from the first; the interference from the film of oxide, which is so annoying in the modification of the apparatus of Ingenhousz, for illustrating the relative conducting powers of bodies, is almost entirely obviated by the high temperature of the source of heat. To avoid injuring the coated surfaces, a thin film of mica may be placed below the phosphorus, the film being large enough to prevent the effect of the spreading of the phosphorus, as it burns.

The plates should be made thin, in order that the results may be mainly dependent upon differences in the radiating power of the surfaces. I have used plates of thin sheet tin, (iron coated with tin,) of sheet zinc, and of glass, with good effect. The effects may be accelerated by coating the under surfaces with lamp black, to promote the absorption of heat; but in that case, care should be taken that the thickness is at least equal to that which produces the greatest amount of absorption.

Instead of the pieces of phosphorus, wax, or other readily fusible material, may be used, as in the apparatus of Ingenhousz; or cones of wood, weighted at the base, and kept upon the plate, with the vertex downward, by a fusible material, may be substituted.

It may happen that the lecture table is so arranged as to render it advantageous to incline the cover, A F, of the box, A G; this will be readily accomplished by making the cover part of the box itself, in which case the melted metal may be introduced through a hole in the higher side; as, for example, in A D.

To illustrate the fact that *absorption and radiation are proportional*, the same square plates, *a a*, &c., may be used; the variously coated surfaces are placed downwards, phosphorus is put, as before, on the upper surfaces, and the frame deposited in its place upon the cover of the box. The phosphorus will now melt in the inverse of the order shown in the first experiment, the plate having the best absorbent surface, heating first. If plates of metal be used, their upper surfaces should be bright, for this illustration; but glass, or mica, which will allow the coating to be seen through, is best adapted to the purpose.

The fact that the *radiation*, or *absorption*, of heat *does not take place merely at the surface*, but at a definite thickness, which becomes very appreciable in good radiators, may be satisfactorily shown by coating the surface of one of the plates with a thin layer of lamp black, and another one with a considerable thickness of the same material. If the coatings be upwards, as in the first illustration, the phosphorus will melt soonest upon the thinly coated plate; if the coatings be downwards, as in the second illustration, the reverse will be the case.

The *effect of transparent screens* in preventing the passage through them of heat not accompanied by light, may be shown by using, in the same instrument, plates of glass, mica, &c., of equal thickness; theoretically, the differential results are not as free from objections as the former ones; but the fact is illustrated almost unexceptionably, since the phosphorus melts first at the surface of the plate, which it

would not do if the plate were cool, and the fusion resulted from the absorption, by the phosphorus, of the heat which had passed through the screen of glass, or mica.

These illustrations I have tried repeatedly, and successfully; there are others of a more refined character, which I have not yet had an opportunity to attempt, but which, I doubt not, might be carried out very easily. The first of these is the curious property discovered in rock salt, by M. Melloni, of permitting the passage of heat of low intensity, as freely as that of high; a piece of phosphorus placed upon the salt, and another upon a thin film of mica, the under surface of which should be coated with lamp black, just above the plate of rock salt, would serve to show this property. That transparent plates of mica are only partially diathermous, would be shown in a similar way, and, in fact, by the relative periods of fusion of the phosphorus just above the plate, and of that upon it, a notion of the relative quantities of heat stopped and transmitted, might be furnished.

Another illustration which I have tried with success, is that of the want of specific effect of colour on the absorption of non-luminous heat; a fact which some researches, undertaken by Professor Courtenay and me, and not yet published, indicate. On coating the plates on one side with lamp black, plumbago, white lead, chalk, prussian blue, vermillion, &c., it will be found that the phosphorus melts upon them without regard to the order of colour. Care should be taken that the thickness of the coatings is such as to give to them each the maximum radiating or absorbing power; a thickness which will differ for each material, but which may, for all, be very easily exceeded.

By a change in the character of the plates, this instrument may be used to advantage in showing the experiment devised by Franklin, and executed first by Ingenhousz, for indicating the relative *conducting powers of solids* for heat.

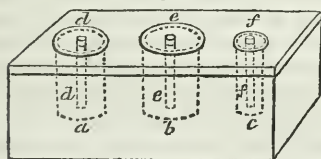
That the experiment just referred to does not truly give the relative conducting powers of bodies, can, I think, be clearly demonstrated, notwithstanding that it is found, in all the books, in juxtaposition with the very elegant and accurate method proposed by Fourier; with the explanation of its intrinsic defects, it may be, however, still admitted as a general illustration. To apply the instrument, plates of the same thickness of the substances to be tested, as, for example, of tin, iron, lead, copper, pottery, wood, glass, &c., which can be easily obtained in the requisite form, are to be coated on both sides with a thick coating of lamp black, or other good absorbent and radiator, leaving a small strip of the upper surface bare, to exhibit the nature of the material; the plates having phosphorus placed, on mica, upon them, are put upon the frame, and this is placed on the cover of the box: the order in which the phosphorus fires, gives the same indication as in the apparatus of Ingenhousz. This effect is more rapid than when cones, or rods, are used, especially from the lower temperature of the substance which is commonly used as a source of heat. These remarks do not apply, of course, to the forms of that apparatus in which hot sand is used.

The second instrument to be described, is intended to show the

common illustration of the fact that bodies have *different specific heats*.

Theoretically, this illustration is, I think, inaccurate, but is *admissible*, like the last; upon this subject, I hope to be able, at a future time, to be more explicit; at present, my remarks are confined to general illustrations. That different bodies require unequal quantities of heat to raise their temperatures through the same number of degrees, is illustrated upon equal weights, or bulks, by subjecting them, when at the same temperatures, to the same source of heat, and proving that they require different times to arrive at the same temperature. This idea is a fundamental one, and cannot too early be inculcated upon a learner. As an illustration, I have three vessels of sheet iron, to contain equal *weights* of mercury, alcohol, and water; these are fastened to a frame, by which they can be dipped into the same vessel containing hot water. An alcohol thermometer, with a column of fluid large enough to be visible at a moderate distance, dips into each vessel. As the heat enters, the thermometer in the mercury rises with great rapidity, that in the alcohol more slowly, and that in the water lags behind both the others. Instead of those thermometers, if a cylinder of any metal which is a good conductor, and has a low specific heat, such as copper, for example, should, after being coated with a varnish of thickened linseed oil to protect the surface, be introduced into each vessel,

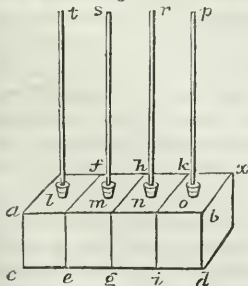
Fig. 2.



phosphorus placed on the top, would melt and inflame first on the metal which dipped into the liquid having the least capacity for heat. In the annexed cut, fig. 2, *a*, *b*, and *c*, are the vessels; *d*, *e*, *f*, metallic cylinders resting in wooden, or metallic, or mica,

disks, and the whole dipping into a vessel, *m n*, of boiling water. The mercury is so small in bulk, that the influence of this strikes the student immediately; but the idea which he thus catches at, is refuted by the more tardy heating of the water, which is less in bulk than the alcohol.

Fig. 3.



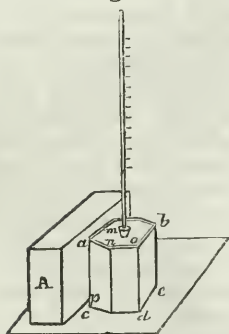
Before the forms of illustration, of the radiation and absorption of heat, already described, had suggested themselves, I had contrived another apparatus, which gave very good results, and may be, by some, preferred to the one already described. A long box, *a b c d x*, of tin, was divided into compartments by partitions, *e f*, *g h*, *i k*, &c., and a top soldered upon each, having a conical opening, *l*, *m*, *n*, &c., to receive a cork, through which a tube, *o p*, *n r*, *m s*, *l t*, &c., passed; these

compartments were made as nearly equal as possible, and the tubes entering them were selected of as nearly equal bore as possible;

equal measures of coloured water were poured through the conical openings into the several compartments, so as to cover the bottom to a depth regulated as will be presently stated. The tubes and corks were now inserted, and cemented; and each cell thus formed an air thermometer, the expansion of the air within driving the coloured liquid up the tube entering the cell. That there might be no error from a want of equality in these thermometers, after bringing the liquid to a convenient height in each of the stems, by forcing air into each, or by dropping liquid from a dropping tube into the tube, the whole was plunged into a vessel of water, of a temperature sufficiently above the original temperature of the air within, to give distances on the tubes, readily divisible into equal parts of sufficient magnitude. These degrees were marked by a rude scale, formed by coloured threads, tied around the tubes. One surface of the box was kept uniformly bright, or regularly tarnished, or coated; the other, *a d*, was coated with substances of different radiating powers.

The box being placed with the uncoated side towards a vessel of warm water, the heat enters uniformly that side of the compartments, but is radiated differently from the opposite side, and the liquid from the air thermometers is urged more rapidly up those tubes which enter into the compartments radiating worst, and ultimately arrives at a greater height, showing a greater stationary temperature, or temperature of equilibrium, between the heat absorbed, and that which is radiated. If the vessel be now turned, so that the variously coated surfaces are towards the source of heat, the liquid in those coated with the best absorbents, will immediately begin to rise in the tubes, and that in those coated with the worst absorbents, to fall. That the two lateral compartments are exposed to a greater cooling action than the others, may be an objection to this apparatus; but it is easily obviated, and with it the communication of heat from one compartment to another, by terminating the box at each end by a small compartment, and separating each of the other compartments by a similar space; in fact, convenience alone was the reason for uniting these air thermometers in one vessel.

Fig. 4.



Another form of apparatus, which is more simple, I have found convenient; but it occupies more time than that last described, in obtaining the same results. A prism of any convenient number of sides, is made into an air thermometer, in the manner described in speaking of the last apparatus; the sides are variously coated; it fits loosely into a prism of the same form, but wanting one side; in the figure, *a b c e*, represents the enveloping surface, and *m n o p*, the air thermometer. To show the different absorbing powers of the different substances, the vessels described are placed as in the figure, before another, *A*, containing hot water, hot sand, or any other convenient source of

heat. Suppose the side of the air thermometer which is the worst absorbent of heat, to be exposed to the source of heat, the air within is expanded, and the position of the liquid in the tube is marked by an index; a better absorbent is exposed, and the liquid rises higher; a worse, and it falls below its original level: the experiment can thus be varied at pleasure. The outer sheath, or covering prism, serves to render the surface, not exposed to the source of heat, uniform in its radiating powers, and to protect those sides which are not intended to be exposed to the source of heat, from the radiation of the vessel, A, which, otherwise, would affect them sensibly. If the air thermometer were a rectangular prism, of course the objection just stated would not apply; but the sheath would still be necessary to equalize the radiation from the surfaces not exposed to the source of heat.

To show the radiating powers of the different surfaces, the sheath is turned so that the open side is exposed to the air; the absorption of heat now becomes sensibly constant, and the greater or less height of the liquid in the tube, is determined by the less or greater radiating power of the exposed surface.

The order in which the surfaces are exposed may, of course, be so arranged as not to require the temperature of the source of heat to be kept constant.

Such an apparatus, placed before a stove, would make an admirable illustration in a school, or a vessel of water, colder or warmer than the room, may be used as the radiating or absorbing body. For the tin vessel here described, a common square glass bottle may be substituted, without disadvantage. Even a common glass phial, made into an air thermometer by inserting a tube through a tight cork, into some liquid occupying the lower part of the phial, and provided with a movable coating of tin foil, gilt paper, writing paper, and paper covered with lamp black, when placed before a fire, or in a room of which the air is warm, when the external air is cold, brought near a window, will afford an interesting and instructive illustration.

Philadelphia, February, 1835.

FRANKLIN INSTITUTE.

Monthly Conversation Meeting.

The fifth conversation meeting of the Institute, for the season, was held at their Hall, Feb. 26th, 1835.

Mr. Thos. Fletcher presented an apparatus which was found in the building at the rear of his premises, immediately after it had been discovered to be on fire. This contrivance was of a most ingenious character, and seemed almost certain to produce the effect intended by its nefarious projectors.

Messrs. Carr & Lunt presented specimens of screw augers, manufactured by David Bassett, of Derby, Connecticut; handsome, well

executed tools. Scarcely a meeting passes without furnishing additional evidence that the time is not far distant, when the ingenuity and industry of our mechanics will render their country independent of foreign aid in almost every species of manufacture.

Mr. Stephen C. Ustick exhibited and explained a machine for cutting straw, patented by himself.

Messrs. A. & G. Ralston presented two models of improved chairs for edge railways, one invented by Mr. Stephenson, engineer, of England, and the other by Major D. B. Douglass. Messrs. Ralston also presented the model of a railway, the invention of Mr. Merrick, of this city, which has received the approbation of several distinguished engineers, and has been recommended, by Mr. Strickland, to the Delaware and Susquehanna Rail-road Company. The rail is in the form of a truck, or trough, inverted; the lower edges flanged outwards, to receive the nails, or clamps. It is believed that this form, or a modification of it, will sustain a greater weight, with a minimum quantity of metal, than any of the edge rails, while it is better adapted to resist a lateral thrust, and may be secured to the blocks without chairs.

Mr. John M'Mullen, of Huntingdon, Penn., exhibited a machine for knitting stockings, which performed all its functions with admirable precision, and appeared to be well adapted to give employment to those whose infirmities prevent a recourse to more laborious occupations.

Mr. Charles Wetherill exhibited a snow owl, prepared by Mr. Brano, of Philadelphia.

Mr. Thomas Ellicott, of Philadelphia, exhibited a platform weighing machine, of his own manufacture, in the perfection of which he has attained a well merited celebrity.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Thomas Ewbank's improved Process for Tinning Lead Pipes.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination, specimens of Lead Pipe, coated with tin, made by Thomas Ewbank, of the city of New York, REPORT:—

That they have examined the specimens of tinned lead pipe submitted to them, and are fully satisfied that the coating of the lead with the tin is complete; and from a description of the process, accompanying the specimens, the committee are induced to believe that, when the pipes are of a limited length, it cannot fail, if proper care be taken by the person who conducts the operation.

The superiority of this method over any former plan known to the committee, is the facility with which the pipes are tinned, merely by drawing them through a bath of fluid metal.

The committee would, therefore, recommend to the Board of Managers, the award of the Scott's legacy premium and medal to Mr. Ewbank, for his important improvement in the process of tinning lead pipes, whereby the cost is but little enhanced, which brings them within the reach of all who may have occasion to make use of the article.

By order of the committee.

WILLIAM HAMILTON, *Actuary.*

March 12th, 1835.

Report on Seth Graham's Method of Extracting the Hair from Fur Skins.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred, by Mr. S. G. Ladd, of Kennebec, Maine, for examination, a machine invented by Mr. Seth Graham, of the same place, for extracting the hair from fur skins, REPORT:—

That its construction is as follows:

A suitable wooden frame supports two fluted iron rollers, about eighteen inches long, placed parallel to each other, and about three or four inches apart, on a horizontal line; each of these rollers is paired with another similar roller, supported beneath it upon a movable frame, so that it may be detached from its fellow, for the purpose of inserting the skin.

One pair of these rollers, which we may call No. 1, by way of distinction, is made to revolve by means of an endless screw, so as to draw the skin slowly through the machine; the other pair is intended merely to keep the skin stretched, by friction. A smooth iron cylinder, of equal length with the rollers, and situated midway between them, is supported upon a movable frame, so that it may be raised or lowered at pleasure. Immediately over this cylinder is placed the pulling knife, which is a flat bar of steel, about eighteen inches long, one and a half inches wide, and half an inch, or more, thick in the middle, but beveled at the edges; this knife revolves upon pivots at its ends, and is furnished with a pulley at one end, and a fly wheel at the other, to communicate and equalize its revolution. An iron cylinder, covered with leather, and called the elastic cylinder, revolves in boxes fixed upon strong springs, which press it firmly against the pulling knife, to which it is parallel.

The skin from which the hair is to be extracted, is inserted between, and firmly grasped by, the fluted rollers; the movable cylinder is then raised, so as to elevate the skin toward the pulling knife. When this has been so adjusted as to bring the knife in contact with the long hairs, but not with the fur, the machine is set in motion; and as the skin is drawn through by the fluted rollers, No. 1, the long hairs are firmly seized between the edges of the pulling knife and the elastic cylinder, and extracted from the skin; a cylindrical brush, revolving above the elastic cylinder, clears it from the loose hairs.

Several skins were passed through the machine, in the presence of a sub-committee, and they noticed with much satisfaction, that the operation of extracting the hair was performed with great celerity, and, when the skins were smooth, and even haired, as perfectly as could be done by hand.

Where there were defects in the skins, the work was imperfectly executed, and, in all cases, a portion at both ends of the skin was left unpulled. These deficiencies form important objections to the machine, as the expense of completing the work would be nearly equal to the cost of unhairing the whole skin. But the committee deem it no more than justice to state as their opinion, that the machine is susceptible of modifications which will, in a great measure, obviate these difficulties. When thus improved, they believe that it will be an important auxiliary to hatters and furriers.

By order of the committee.

WILLIAM HAMILTON, *Actuary.*

March 12th, 1835.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1834.

With Remarks and Exemplifications, by the Editor.

1. For an improvement in *Railway Cars, or Carriages*; Ross Winans, Civil Engineer, city of Baltimore, October 1.

The specification will hereafter be published.

2. For an improvement in the *Suction Pump*; Elijah Whiton, Groton, Middlesex county, Massachusetts, October 2.

The patentee states that he has made the following improvements:

"1st. The barrels of a pump made of steatite, or soap stone.

"2d. A new and useful method of uniting the barrels of pumps, whether of stone or metal.

"3d. A new and useful method of constructing the lower box.

"4th. A new and useful method of draining the water from pumps."

A patent was some time since obtained for making a pump chamber of marble, and if that was a good claim, the present one, for the use of soap stone, may be so also; but, if so, we think it must be on the ground of its being a "new manufacture," and not as an improvement in the pump.

The account given in the second and third of the above items, does not present any thing worthy of particular notice. The fourth is for a contrivance by which it is intended to open both the valves, and thus to allow the water to descend, and prevent its freezing. There is to be a sort of spring catch on the upper surface of the valve of the lower box, which, when the pump handle is raised to the greatest possible height, hooks on to a ring, or other suitable appendage, on the lower end of the piston, whilst, at the same time, a projecting pin

opens the valve in the piston, or bucket, and the water necessarily descends into the well, or reservoir.

Other contrivances have been made to accomplish this last mentioned end; the patentee, however, has a right to his own plan, if it be new, as we believe it is. There is no claim made, and the object of the patent must, therefore, be inferred from the four points enumerated as constituting the improvements.

3. For a *Revolving Washing Machine*; John D. Gwinn, Washington county, Tennessee, October 3.

A square box, to contain the clothes, is to revolve on gudgeons, one of them being furnished with a crank, by which to turn it; the other gudgeon is hollow, and extends into an open box, or trough, into which soap-suds may be poured, in order to supply the revolving box, without the necessity of opening the door at which the clothes are introduced; we presume that the dependence for the validity of this patent, is placed upon the hollow gudgeon, and open trough, although this is not very clearly expressed; the advantage of the falling of the clothes in the square box, a thing by no means new, is also insisted on.

4. For a *Straw Cutter*; Stephen Ustick, city of Philadelphia, October 4.

There is, we think, considerable novelty in certain parts of this machine, but it has the fault of too much complexity. The straw is to be contained in a trough, in the usual way, and is to be fed by fluted rollers of cast-iron. The knife stands horizontally, or nearly so, across a frame to which it is firmly attached. The lower edge of this frame rests upon ways, which form an inclined plane, and, consequently, as the frame slides, the knife descends with a drawing motion. To cause the frame to slide backwards and forwards, there is a pitman, worked by a crank, on the shaft of a fly wheel in front of the machine.

The claim is to "the arrangement of the bottom of the trough; the opposing edge; the feed rollers; the position of the knife; the direction of the knife frame collectively; and the position of the machine, as above described."

Although there is enough in this machine upon which to found a claim, the foregoing appears to us defective in claiming individual parts which are not new, instead of depending, almost exclusively, upon the arrangement and connexion of those parts, in which its novelty principally consists. The feeding rollers, as such, are not new; nor is an opposing edge, to resist the cut of the knife. We have carefully looked over the specification, but are far from having a clear idea of what is included in "the arrangement of the bottom of the trough;" if this part contains any thing peculiar, it is not explained.

5. For an improvement in *Schutes or Sluices in Dams, for the descent of Arks, &c.*; Amos Addis, Washington, Lycoming county, Pennsylvania, October 4.

The claim made in the specification of this patent, is to "every mode of extension of the schute into the pool of the dams; as all extensions above the breast of the dam is my improvement on the present schute, with the inclined plane at the bottom of the schute."

We are unable to understand the, so called, description of this improvement, and cannot, therefore, attempt to epitomize it. This being the case, we dismiss it by giving the claim alone.

6. For a *Horse Power*; William G. Johnston, Bridgetown, Cumberland county, New Jersey, October 4.

An inclined movable floor is formed with slats of timber, connected by endless chains, which pass over cylinders at each end of the machine, friction wheels being used to sustain it; all these parts are combined together in a manner differing so little from what has been frequently done, that it would be a difficult, and at the same time a useless, task to point out the novelty of the contrivance; the patentee has not attempted it, but claims "the combination and arrangement of the several parts of the machine, and the mode of applying the gearing by which the motion is obtained and communicated."

7. For a *Machine to produce Alternate Motion*; Benjamin Elliot, Danby, Tompkins county, New York, October 4.

The alternate motion to be produced by this machine, is said to be applicable to churns, and to the propelling of other machinery; the apparatus described is one of those unmechanical contrivances, in examining which a person who has no, or but little, acquaintance with the subject, may readily become bewildered, and imagine that, by the time the action of the first mover is transmitted through the long train of levers, wheels, and pinions, some wonderful effect must be produced.

A weight is to be wound up, and the shaft upon which it is wound is to operate upon a sort of pendulum, which in its turn, through the intermedium of wheels, pinions, levers, &c., is to afford great assistance to the dairy-maid, who, however, will soon be willing to dispense with its services.

8. For an improvement in machinery for *Making Twisted Roving*; Peleg Arnold, Killingly, Windham county, Connecticut, October 6.

The claim made is to "the following parts, put together in the following manner, for making twisted roving, and laying it upon the bobbin. The top part of the flyer is a cylindrical box, which is attached to its arms. This box has a tube, or pipe, passing down the centre, through which the roving descends; the top part of this tube forms the nose, or top bearing, of the flyer. In the box is a heart and gear, connected together by a pipe, or barrel, having a circular

horizontal motion round the tube through which the roving descends; this passes down through the centre of the gear, barrel, and heart. The heart has a circular horizontal motion between two prongs of a tube, which gives the tube a vibrating motion that distributes the roving on the bobbin; this tube is hung on pivots at the top, where the prongs are connected; the bearings of the pivots are attached to the box, which turns with the flyer. The regulating circular motion of the heart, and the vibrating motion of the tube, are taken from a circular perpendicular motion of a bobbin, which has a circular horizontal one at the same time," &c.

9. For improvements in *Saw Mills*; Othniel Stone, Pittsford, Monroe county, New York, October 6.

A saw is to be so made as to form a band, or hoop, of any convenient diameter and width; this band is to be passed, like a strap, over two circular drums, one above the other, and the sawing is to be effected by the straight part between the drums; these latter are to have projecting rims, to bear against the back of the saw. To prevent the saw from trembling, it is to pass between friction rollers, stationed just below and above the timber to be sawed.

"The specific new and useful improvements hereinbefore described, and claimed by me as the inventor, are the following.

"First. The shape of the saw. Second. The manner of hanging the saw. Third. The manner of keeping the saw steady, when in motion, by means of rollers. Fourth. The manner of making the saw with teeth on one or both edges."

We have, on more than one occasion, had to refer to the article *SAWING*, in Rees' Cyclopaedia, in which this saw is mentioned as having been patented in England, long ago; how frequently it has sought the same sanction with us, we shall not stop to inquire; but we know that it was patented in 1817, by Adam Stewart, of Baltimore, Maryland; the practical difficulties, however, attending its construction and use, soon convinced its reinventors that it was best to abandon it.

10. For an improved *Gas Metre*; James Bogardus, city of New York, October 7.

(See description.)

11. For an improvement in the *Gun Lock*; J. B. Gray, Fredericksburg, Spottsylvania county, Virginia, October 7.

The claim made in this specification is to "the arrangement of the rod, and of the spring, and the adjustment of the notch to the spring placed beneath it." We are not told in what particular this lock is supposed to excel those in use, nor are we able to discover it. The description given is very far from clear, but the drawing which accompanies it is well executed.

12. For a machine for *Cutting Laths*; William W. Lesuer, Urbana, Champaign county, Ohio, October 8.

The laths made by this machine are to be cut from boards, of a thickness proper for the width of a lath, and of a suitable length. A strong, horizontal bench, is prepared, and upon this is placed a frame, which carries a knife as long as the intended lath. The sliding frame to which the knife is attached, receives its motion from a crank and pitman. The carriage is hinged to one side of the frame by two straps of iron, working like the connecting pieces of the common parallel ruler; the board is placed on its edge in a proper mortise, and as the crank moves the pitman, the knife is brought up against the board by a circular, sweeping motion, separating the lath, and allowing it to fall through the mortise. There are mentioned in the description, many parts to which we have not alluded, as they are mere accessories, such as any competent workman could supply. The only thing that we deem new in this machine, is the manner of hinging the knife, by means of jointed straps; in other respects, it does not differ essentially from that patented by D. Hubbard, and described at page 105. The patentee, however, has not only claimed these, but much more, as "the hinges, the carriage and parallel beam, the pitman, and joints as there applied; together with the general construction of the machine, or the combination of the parts above mentioned, with the superficial cross pieces, supporters, knife, axle, &c., for the purpose set forth."

13. For *Preserving Timber from decay*; Forrest Shepherd, Fredericksburg, Spottsylvania county, Virginia, October 8.

The wood is first to be steamed, or boiled, to "destroy the sap, or principle of decay," and after this to be immersed in pyroligneous acid, until saturated. The patentee says that he also preserves wood from decay, and from destruction by worms, by boiling it in a solution of sulphate of iron, sulphate of alumine, and muriate of soda; or, in other words, in a solution of copperas, alum, and common salt, taking half an ounce of each to a gallon of water. This is all the information given, and no claim is made.

We apprehend that the foregoing directions are altogether empirical, and that the patentee has been guided more by his hopes than by his experience, which ought, in such a case, to be the result of long continued and varied observation. A patent was lately obtained for saturating timber with lime, which was to neutralize the acid supposed to be contained in it; in the present instance, it is to be made to imbibe as much acid as possible; these views are theoretical, or rather hypothetical, and must not be depended upon as guides. The foregoing specification makes no claim, offers little or nothing that is new, and merely lays before us several recipes, from which to make a choice. The saline solutions named will do much towards rendering the wood incombustible, if they do not protect it against the attacks of the dry rot.

14. For machinery for making *Horse or Ox Shoes*; Ezekiel Davis, Barre, and Samuel Field, Oakham, Worcester county, Massachusetts, October 8.

In the lower part of a very stout frame of cast-iron, a horizontal spindle is to run, in the manner of a lathe mandrel; one end of this spindle is to project through a collar, and to carry a kind of chuck, the face of which is to be grooved, so as to form a mould, into which the heated iron is to be forced in order to convert it into shoes. This moulding face is to be about sixteen inches in diameter, and the groove about two inches clear of its edge. When horse shoes are to be formed, the indentations for two of them are contained in the circle, two cutters, or chisels, being placed in it to divide the iron; for ox shoes, four such cutters are used. There are to be creasing dies, corresponding with the number of shoes, on which are raised as many projections as there are nails to be employed. A punch, or punches, operated upon by cams, and passing through the moulder, are to throw the shoes out of the groove.

In order to force the iron into the moulding groove, there is a roller revolving vertically, the lower end of which roller projects through a collar, and bears against the face of the moulder. The heated bar is to be passed through an opening, or notch, which guides it between the roller and the groove, by which it is to receive its form.

“The invention claimed is the plate, or mould, and the manner in which that, the spindle, and roller, are placed to produce the effect; the punches to throw out the shoe, and the application of water to cool the mould; and the slide to assist in throwing off the shoe.”

We do not see in this machinery any thing calculated to remove the difficulties which have been hitherto encountered in the attempts to make horse shoes by rolling. There has in every instance, we believe, been a considerable waste of metal, and fins have been left upon the edges, which not only increase the waste, but are difficult to remove; and, after all, the horse shoe is not completed by the machine, but has to undergo considerable forging to prepare it for use. We predict, therefore, that it will prove a total failure.

15. For an improvement in the *Plough*; Joseph Cromwell, Cynthiana, Harrison county, Kentucky, October 9.

The land side, share, and mould board, are each to be of wrought iron. The land side and share are to be connected at the point by welding, or otherwise, but are to be separated from the mould board. The share is to be confined to the mould board by means of a staple, or socket. “The improvements claimed, consist of the means by which the share is confined to the mould board, and the hooks by which the beam and land side are confined together ”

17. For an improvement in the *Machine for Shelling Corn*; Timothy Wellman, Jr., Brookline, Windham county, Vermont, October 9.

This corn shelling machine is, in all its essential points, the same with that which was first invented, and for which a patent was obtained, upwards of thirty years ago. It consists of a cylinder set with teeth, with a concave similarly armed, and borne up against it by means of springs, to adapt it to ears of different sizes. The claim made is to "the shell (or concave) being made capable of being elevated, or depressed, by large or small ears of corn, which enables it to shell all sizes of corn with equal facility."

17. For a *Cooking Stove*; Covington Wilson, city of New York, October 10.

This stove is of cast-iron, and may be said to consist of two oblong rectangular boxes, placed one above the other; the lower box, or division, of which contains the grate, and the oven. This lower part may be about twice the length and depth of the grate, the latter being formed with front and bottom bars, in the usual manner of grates for anthracite; this grate is contained entirely within the lower division, and when the front bars are enclosed within doors fixed for that purpose, the front of the box has no projection on it. That portion of this lower compartment not occupied by the grate, constitutes the oven, which is heated both by the end and back plates of the grate, the oven being consequently in the form of a double L. There are doors at each end, and also at the back, of this compartment, opening into the oven, and the lower part of the grate is but little elevated above the plate which forms the bottom of the oven. There is an ash pit under the fire; but both this, and the front of the grate, may be closed by a fender, and by doors, constructed for the purpose, so as to govern the draft.

The upper, or cooking, compartment may be of the same dimensions with the lower, one plate forming the bottom of the former, and the top of the latter. It has an opening in front, which may be closed by sliding doors. Within this part, pots or kettles of any kind are to be placed; it has a flue at its back, extending up to the top plate, where a pipe may be attached. That part of the bottom plate of this compartment which is immediately over the fire, may be taken out, so as to expose such articles as require it, to its direct action. The stove has legs, to elevate it to a sufficient height above the floor.

"The claim is to "the placing the fire chamber in the middle of the oven, so that the latter may receive the heat of the three sides thereof at once;—the plan of closing the ash pit with a fender, so as to answer the purpose of an oven, to bake or broil by the heat of the bottom of the fire of the grate;—the arrangement of the cooking chamber with its movable section and chimney, by the joint management of which the doors of said chamber may be used as dampers to regulate the draft."

18. For a *Machine for Punching Metals*; Levi C. Bunnell, Otsego, Otsego county, New York, October 10.

"The general arrangement of the machine" described in the specification of this patent, constitutes the claim. Its foundation is a block of wood, eight feet long, ten inches wide, and eight thick, and the apparatus for punching is situated at the middle of this block. One end of a lever works upon a pin passed through strong cheeks, and forms a cam, or eccentric, which, when the lever is brought down, acts upon a driver, that descends perpendicularly into the block, and has on its lower end the punch, which extends down to about the middle of the block. The driver is raised by springs when the lever is lifted. The die plate, or bed piece, is placed on the lower side of a mortise made through the block, and into this mortise the piece to be punched must be passed. This is "the general arrangement of the machine," which appears not to contain one single thing that is worthy of being patented. It is very much like several of those machines used for gumming mill saws, but is inferior to such of them as have a bed block entirely of cast iron, as much of the power employed will be lost, from the elasticity of the wood.

19. For apparatus for *Tightening Rigging*; David Stackpole, Portland, Cumberland county, Maine, October 10.

This machine is intended for setting up, or tightening, the shrouds and other rigging on board of vessels. It consists of an iron screw, that plays into nuts, supported in an iron frame. The screw has a hole through the head of it, in which to insert the lever by which it is to be turned; its length must be regulated by the nature of the service it is to perform. One of these instruments is to be fixed to every shroud, or stay. The bottom end of the frame is to be attached to the chain plates, and the head of the screw to the shroud, or rigging, by means of a swivel in the form of a stirrup, and a thimble.

The foregoing contains the whole description, and nearly in the words of the patentee.

20. For a *Machine for Moulding and Pressing Bricks*; Nathaniel Adams, Cromwell, Orange county, New York. First patented June 22, 1832. Patent surrendered, and reissued upon an amended specification, October 14.

The patent, as formerly taken, (see page 229, vol. vi.,) was for "Grinding or preparing clay for bricks, and for moulding and pressing the same." In the present specification, the grinding apparatus is wholly omitted, the patent being confined to the press, and the claim made is as follows:—"In this machine, the follower, and the apparatus used for raising, depressing, or spreading it, whether used in connection with the contrivance for moving the mould by pinion and rack, or in any other manner, for the purpose within mentioned, I claim as my invention."

21. For an improvement in the common *Cooking Stove*; Henry W. Camp, Owego, Tioga county, New York, October 14.

What are called improvements in this stove, consist in the partic-

ular manner of arranging the respective parts, and more especially the flues.

“The improvements claimed are principally as follows.

“1st. In the form and construction of the flues and dampers, for the purpose of directing and regulating the fire; being so constructed as to cause a draught of heat both ways, and equalize or turn it one way or the other, by simply moving one or both dampers, so as to apply the heat where it may be needed, and turn it under the oven, or not, or partially so, for baking with greater safety, and better. The heat being by this process distributed equally, if necessary, through the whole stove, and applied so directly on the boilers, or cooking utensils, or oven, as to require less fuel than any other differently constructed stove, or fireplace, whatever, to furnish the same facilities.

“2d. In the form and construction of the fire hearth, comprising an ordinary hearth on the top plate, for ordinary use and convenience, and a sunk hearth under it, which can, with the sunk plate within the stove, contain convenient quantities of coals and ashes for cooking, and forms a receptacle for ashes from the burning fuel, which is upheld by the grate above described; by means of this and the draught, made to burn freely and advantageously. This draught being caused and increased or diminished by means of a hole in the centre of the upper plate of the hearth, and the partial or entire removal of the plate, which is removed entirely to admit of a gridiron, or other cooking utensil.”

We have not yet passed half way through the claims, and will, therefore, to save space, give a mere outline of the remainder.

4th. The situation of the main flue, and the dampers by which it is governed.

5th. The formation of the perpendicular plates, which form the flues, &c.

6th. The formation of the top plate, and the location of the four boilers.

7th. The form and location of the fire grate, &c.

We have found the claim too long for insertion, and are very apprehensive that, if tested in court, the patentee will learn that he has made it *too broad* also. The basis upon which a patent must be sustained, is the *invention*, and not the *claim*, of the applicant; but, as in the case before us, patentees are very apt to mistake the one for the other.

22. For an improvement in Hull's *Portable Bake-oven*; Henry Caldwell, Owego, Tioga county, New York, October 14.

We shall not look back after Hull's oven, to see how that was made, but describe at once that now presented to us, which is “of tin and iron, twenty inches in length, by fourteen in breadth, and fourteen in height, independently of the legs, or supporters;” and so far as we can ascertain from the picture and description, it is an oblong box, formed of single plates, with a door in the front, a re-

ceptacle for fuel underneath, and a flue, or pipe, running up at the back part, to connect with a stove pipe.

“The improvements claimed are as follows. 1st. In the application of the fire to the oven. 2d. In the pipe for carrying off the smoke, or fumes, from the fire used in the stove part, instead of suffering it to escape into the room. 3d. In the cylinder, or covering, around the pipe inside of the oven, called the protection. 4th. In the stove part being so constructed that it may be used for warming houses.”

It is quite obvious that, if Hull’s oven allowed the smoke and fumes to escape into the room, it required improvement; but the improvement made, although it may be new to Hull’s oven, is certainly very old in its application to others. How novel it may be, also, to place a fire so that it may warm a room, as well as roast a loin of mutton, we have yet to learn. It has been more frequently attempted, and found of more difficult attainment, to keep the heat in, than to let it out of, a cooking apparatus.

23. For a *Furnace for Heating Bar Iron with Anthracite and Bituminous Coal combined*; Henry Burden, Troy, Rensselaer county, New York, October 14.

The patentee states that the common method of constructing furnaces for heating bar iron by anthracite, is to make them about three feet wide, and four or five long, with grates of these dimensions, and a door at one end for admitting the fuel, and the bars to be heated; the grates have on them a layer of three or four inches, in thickness, of ignited anthracite, upon which the bars are laid; but as flame from this fuel will not fill the space between the iron and the arch, and the heat is unequally distributed, the draft through the grate being more obstructed in one part than in another, the bars are frequently overheated, burnt, or melted, in spots.

To remedy this defect, the improved furnace is lengthened about one foot, and furnished with a door at each end; the anthracite is laid on the grate as usual, and when the bars are heated to such a degree as not to endanger their burning, the hinder door is opened, and a small portion of bituminous coal thrown into the back part of the furnace, which, flashing into flame, fills the furnace therewith as it passes over the iron in its way to the chimney, and equalizes the heat of the bars.

The improvements claimed are, “First. Making the furnace with a door at the back end, so as to admit of the bituminous coal being put into the back part of the furnace. Secondly. Using the bituminous coal on a part of the grate at the back part of the furnace, reserved for that purpose, which gives the coal an opportunity of ignition, as well as could be by a reverberatory or puddling furnace, before it comes in contact with the iron. Thirdly. In combining the use of anthracite and bituminous coal, for the purpose of heating bar, or other iron, at the same time igniting each in separate parts of the furnace.”

From the nature of the thing, as set forth, and the known talents and experience of the patentee, we have no doubt whatever that the foregoing is a real and great improvement in the process to which it appertains.

24. For a *Machine for Planting Corn*; Henry Blair, Glenn-ross, Montgomery county, Maryland, October 14.

This planting machine does not differ in its mode of action, and but slightly in the arrangement of its parts, from others that have been constructed for the same purpose. A frame is made, which is sustained by two wheels made fast upon a common axis. This axis carries a hollow cylinder, from which the corn is to be dropped through holes at suitable distances; a hopper to contain the seed corn surmounts, and fits on to, this cylinder, but not so as to impede its revolution, which is effected by the wheels. A shovel plough, attached to the frame, precedes the dropping cylinder, and two coverers, or scrapers, follow it, and behind them a harrow also is attached to the frame. The machine is to be drawn and guided in the manner of a plough. The claim is to "the combination and arrangement of the several parts."

Since a late decision in the Circuit Court of the United States, sustaining a claim to the combination and general arrangement of a patented machine, this form of claim has become quite fashionable, and appears to be thought talismanic; it will be found, however, that such combination and arrangement must be substantially new, and must differ essentially from all things for the same purpose before known or used, as a defect in a thing itself is not to be cured by cabalistical words.

25. For an improvement in the *Power Loom*, for weaving diaper, and other figured fabrics; James M. Hoggan, an alien, who has resided two years in the United States; New Haven, Connecticut, October 14.

We shall not attempt to epitomize the description of this loom, which is of great length, and refers to drawings, in which the machine is minutely and fully represented. Many parts of it are, of course, perfectly similar to the power looms previously in use; the running gear, and the mode of communicating the power, do not differ from those employed in the broadcloth power loom. The points claimed relate exclusively to the construction and arrangement of the parts by which the figures are formed.

26. For an improvement in the *Apparatus for Distillation*; Joseph T. Dwyer, Nashville, Tennessee. An alien, who has declared his intention to become a citizen of the United States; October 14.

On the 19th of November, 1833, a patent for a similar object was obtained by the same person. This was noticed at p. 264, vol. xiii. Although the mode now described may be said to be similar in prin-

ciple with the former, there is considerable difference in the manner of carrying this principle into effect. A tube rises vertically from the top of a still head, and passes through the centre of the bottom of a round tub, formed like a washing tub, and within this is placed the apparatus alluded to. A flat, metallic drum, or hollow disk, stands a little above the bottom of the tub, and the vapour from the still passes into this drum, through the tube above mentioned. Parallel to this first drum, and at a convenient distance above it, within the tub, is placed a similar drum, or disk; and a number of tubes, bent so as to form a semicircle, connect these two drums together, by entering through their cylindrical peripheries. From the centre of the upper drum, or hollow disk, a tube rises, which conveys the vapour into an ordinary worm, or cooler. As a portion of the less volatile vapour will be condensed in the upper drum, a tube leads down from its lower side, into, or through, the first named drum, so as to re-convey it into the still. The claim is "the general arrangement herein stated."

27. For *Curing Smokey Chimnies*; Urban B. A. Lange, city of Philadelphia. An alien, who has resided two years in the United States; October 14.

This patented apparatus consists of two sets of slats, fixed in a suitable frame, and placed like those of venetian blinds. The two frames are to be inclined towards each other, like the two sides of a roof, the slats pointing upwards. This is to be placed on the top of the chimney, and over it a case, or box, open at the sides, which case, or box, is to prevent the blowing of wind down the chimney. The affair is not very clearly described, nor is there any claim made. Like other contrivances for the same purpose, it will probably sometimes succeed, and at others fail.

28. For a new and useful mode of *Cutting Shoes*; Samuel Hayner, Malden, Middlesex county, Massachusetts, October 16.

This improvement is called the "Perpetual Shoe Pattern," and is said to consist in the applying in a suitable frame any number of shoe shapes, so arranged as to leave the least possible space between them. These shapes are to be made of pasteboard, or of any other soft material. The leather is first to be cut into strips, of such width as will suit the frame containing the shapes, and these strips are to be placed on each other, so as to have as many thicknesses as can be conveniently cut through at once. The claim is to "the combination in successive order of any desired number of shoe patterns, for the purpose of being applied by the manufacturer, in cutting out any number of shoes he may require, with the least expense of time and stock."

The practical *clicker* must judge of the difficulty of cutting accurately, with a knife, through several skins at the same time, and also

of the convenience with which such patterns can be used when fixed in frames. The drawings have no "written references."

29. For the *Application of Caoutchouc to Ropes* for dragging Cars on Inclined Planes, &c.; Patrick Markie, city of New York, October 16.

The specification closes with the remark, that "A solution of India rubber has been in use for some time past, in rendering cloths impermeable to moisture, for making elastic shoes, and for many other purposes, but has never been employed on ropes used on the inclined planes of railways, or in the shafts of mines, for which specific purpose I claim a patent."

The foregoing patent has been surrendered, and a new one issued, the specification of which we shall publish in due course. In the mean time, we will observe, that India rubber ropes, for railways, are advertised among other imported articles.

30. For a *Cotton Press*; Thomas H. Scarborough, Brownsville, Haywood county, Tennessee, October 16.

The present patent is taken for an improvement on a press, for which one was issued to Philemon White, on the 19th of February, 1827. A beam extends horizontally along, its two ends being guided between upright checks. A follower shaft descends from near the middle of this beam, forcing a follower down into a pressing box; the two ends of the beam are to be alternately brought down by levers and chains, and confined by bolts passing through holes in the checks. As this is a less convenient press than some others used for the same purpose, we shall not attempt a more particular description of it; nor could we offer much in favour of its novelty, even in its improved form.

31. For *Tackle Blocks, or Pulleys, of Cast-iron*; James Barron, Esq., United States Navy, stationed at the Navy Yard, Philadelphia; October 20.

The claim made is to the forming the shell of this machine of cast iron, or any other cast metal; and it is observed that, although such a block may be much diminished in size, when compared with those in use, yet it will be sufficiently strong for all required purposes. It is further observed, that there are various blocks which are not called *tackle blocks*, but yet it is intended to claim the making the shell of *all blocks* in the way designated.

The shells of blocks have been frequently made of wrought iron, but we are not aware that they have been cast of that metal, because, when great strength is required in a small compass, wrought iron is manifestly preferable to cast, the latter, however, offering no small advantage in first cost. It is said in the *Traité Complet de Mécanique*, by *Borgnis*, p. 62 and 63, of vol. ii., that "the cases, or shells, of pulleys are made either of elm, or of iron," and that "figures 7,

10 and 13, represent compound blocks, with cases, or shells, of iron; these occupy less space than those of wood; but I am of opinion that, for compound blocks of large size, those of wood, properly strengthened by ferules, and bands of iron, are to be preferred; in the first place, because they are more to be depended upon; for experience has proved that iron is more subject to unforeseen accidents than wood, such as breaking, or bending; the defects in wood are apparent, and may be seen at first sight, whilst, on the contrary, those in iron sometimes elude the observation of persons of the greatest experience. Secondly, the little thickness usually given to the iron partitions which separate the sheeves, in order to obtain lightness, endangers the constant friction of the cords against each other, and against the edges of the iron, with which they come in contact in their passage."

These observations refer to wrought iron, and although the objections under the second head may be in a great degree obviated in cast-iron, we are of opinion that those under the first will apply with sufficient force to prevent the general adoption of the plan.

32. For a *Machine for Turning and Channeling Horse Shoe Shapes*; Charles B. Reed, West Bridgewater, Plymouth county, Massachusetts, October 20.

This machine is very fully described, and very accurately represented in the drawing, leaving nothing to be desired on these points. Its respective parts, also, are arranged with much skill, and it appears more likely to effect the intended object than most of its predecessors. We, however, shall not attempt a particular description, in the absence of an engraving.

"The said Charles B. Reed claims as his own invention, so much of the said machine as is employed in the several particulars which follow, viz: that part which confines the iron when bent to the mould, and makes it conform to the mould, when the stamp performs its operation. Also that part which is employed in channeling and shaping the surface of the shoe by means of a stamp. Also that part which prevents the iron from twisting or turning, when the mould carries it under the stamp. Also that part thereof which disengages the mould from the shoe. And also that part thereof which discharges the shoe from the machine; all these several parts performing their labour at one operation of the machine."

There is at one end of this machine two vertical posts, which support the stamping, or rather the pressing, apparatus. At the lower part of this apparatus there is a die for channeling, and otherwise forming, the face of the shoe. The bar of iron is to be heated, and placed against proper rests, when a carriage, having on it a projecting mould, or pattern, of the shape of the inside of the shoe, is brought up against it by the action of a cam on a revolving shaft. This carries it under the die, which is then brought down by a pushing bar, acting on a toggle joint. When the bar is thus pressed, jaws close

upon it laterally, causing it to fit to the mould, and giving it the correct shape exteriorly.

There is, in such machines, one difficulty which it appears impossible to overcome, namely, that of distributing the metal by pressure in such a manner as that every part of the article made shall have its proper section; were the quantity of metal the same in every part, the giving to it the requisite form would be an easy task; but this is not the case with horse shoes, and, in fact, with but few of the articles usually made by the blacksmith.

33. For a *Thrashing Machine*; John Brown, Jackson, Madison county, Tennessee, October 21.

We need not describe this machine, except in one particular point of its formation, this being the only thing claimed. The cylinder is grooved from end to end, in such a manner as to give to its section the form of saw teeth, and the vertical part of these teeth, which constitute the beaters, are faced with iron.

34. For a *Mortising and Tenoning Machine*; Erastus M. Shaw, Brooklyn, King's county, New York, October 21.

The drawing of this machine does not exhibit those parts in detail upon which an estimate of its novelty and utility is dependent, and without an acquaintance with these, the points claimed cannot be understood; we therefore pass it over.

35. For a *Rotary Cylinder Cannon*; John W. Cochran, Lowell, Middlesex county, Massachusetts, October 22.

It is believed by the inventor that "in actual service, either in attack or defence, the Rotary Cylinder Cannon will constitute a most formidable battery, being so constructed that discharges to almost any given or requisite number, and in rapid succession, and in a very limited period, may be made with accuracy, and with as unerring aim as with any other ordnance."

So far every thing is quite *promising*; but the value of promises, all will admit, is dependent upon the manner in which they are fulfilled, and, for our own part, we had rather be among those to be fired at, than in the company of the cannoneers, when this gun is discharged, as we should be much more in fear of the breech than of the ball. The barrel part of these guns is to be formed and mounted upon a carriage as usual, but the breech is to consist of a solid metallic cylinder, the periphery of which is to bear against the bore of the cannon, and to be capable of revolving upon gudgeons. This cylinder is to be bored so as to form any desired number of chambers, which are to receive the charges, and these are to be brought round in succession, so as to coincide with the bore of the gun. The breech is to be made to revolve by an endless screw working in a toothed wheel, and there is a contrivance intended to deposit, upon a nipple, percussion caps, which are to be exploded by a hammer. To render this gun the more formidable, it is represented in the drawing as double barrel-

led, the two barrels to be discharged at the same time, two chambers being excavated in the cylinder, side by side.

We think it very probable that the patentee would never have needed a patent, excepting, perhaps, a patent coffin, had he, before seeking to obtain it, "made, constructed, and applied to use, his said invention or discovery." Our reasons for this opinion will not be required by those who have any knowledge upon the subject, and we cannot take time to prepare a horn book for others. Even the firing of ordnance by percussion locks has been attended with difficulties of no ordinary character, as is well known to many who have tried it.

36. For an improvement in the construction of *Pumps*; Joel Farnam, Stillwater, Saratoga county, New York, October 22.

The cylinder of this pump is placed horizontally, being firmly secured upon a bench by bolts passing through flanches, or projecting ears. The piston rod passes through a stuffing box at one end, the other end being entirely closed. Upon the piston rod there is a rack, and the rod is moved backward and forward by a vertical lever, having a circular segment, furnished with teeth, at its lower end. The water is received through openings in the middle of the cylinder, at its under side, and is discharged through a pipe similarly situated at its top. These openings are enclosed by projecting chambers on the upper and lower sides of the piston; the internal arrangement of the cylinder, with its openings, valves, and chambers, are not represented in the drawing, which shows nothing more than the outside form of the instrument. It is possible that, by a close study of the specification, we might arrive at some knowledge of the interior, but this part ought to have been exhibited most distinctly in the drawing, which, without it, has but little value.

The points claimed "are the receiving and discharging the water through the cylinder, by means of arms, together with the peculiar form and combination to effect that purpose. But the most essential advantage which I claim as effected by this combination, is, that no dependence is placed on bolts or packing to keep it from leaking, the water having no chance to escape but through the solid metal, except through the stuffing box."

37. For a *Still*; John Wright, city of New York, October 22.

It is here intended to produce alcohol from whiskey at one running, and the construction of the head of the still by which this is to be effected, is represented in the drawing, but no claim whatever is made. There are parts of the apparatus which are not new, and it is not the province of others to tell the patentee how much of it he has invented; and, indeed, were we to do so, it is not unlikely that he would think our measure a false one. Although there is nothing new in the principle of this still, we think that there is quite enough in its particular arrangement upon which to found a valid claim.

38. For a machine or apparatus for *Tanning Leather*; Lemuel C. Dudley, and Samuel Brooks, Portland, Cumberland county, Maine, October 23.

We have here again a patent without any claim, and without much novelty, excepting in the application of steam to a purpose which might be more readily and economically effected in other ways.

There is to be a leech, or vat, above ground, for preparing the tanning liquor, and a reservoir attached to it to receive the liquor as it passes from the leech; it is thence to be conducted into a long tube, on the under side of which there is a number of cocks, to which the skins or hides to be tanned, are to be attached. For this purpose, they are to be formed into bags, as is done in the making of morocco leather. The tanning liquor is to ooze through the skins, and to be caught in a large tub. "From the receiver the liquor is forced back through a lead pipe, by means of a steam boiler, which is connected with the receiver by another lead pipe." This is all we hear about the steam, and as respects the process described, it has been sufficiently tried to prove that it will not make good leather, nor would a claim to it render it new, when it is not so in fact.

39. For an improvement in the *Running Gears of Rail-road Carriages*; James Stimpson, city of Baltimore, October 23.

This improvement consists simply in dividing the axle of the hind wheels in two at the middle, and forming a flanch on each end, which may rise one-fourth of an inch, and fit into a corresponding cavity in a coupling box fixed under the centre of the carriage. The object to be attained is to allow the hind wheels to run with different velocities upon curved parts of the road, and thus to follow the fore wheels, the cone upon the tread of which will guide them correctly; whilst the vibration of the axles, to preserve their parallelism, is rendered unnecessary. The claim is to "the application of the joint to one of the axles of any description of rail-road carriages and locomotives, whereby to allow the hind wheels to yield to the direction required to be given by any change in the direction of the road; or to the conical form of the wheels, upon the fore axle, or any other mode whereby the same object is attained by the same principle of action, or construction; and also for all other carriages to which it may be beneficially applied."

We do not perceive the difference in principle, or in effect, between this plan, and that of allowing one of the hind wheels to turn on the axle, whilst the other is fastened thereto; a practice which was adopted on rail-road cars, many years since.

40. For a *Machine for Boring Timber*; Benjamin Knight, Cranston, Providence county, Rhode Island, October 23.

This is a patent for a "Machine for boring timber for mortising in the framing of buildings, of all descriptions." The machine is to be attached, by clamps of a peculiar construction, to the timber to be

bored. The auger is to be turned by a crank acting upon a bevil gear, and the whole apparatus is so constructed as greatly to facilitate the operation of boring. The claim is to "a slide placed on the main frame, and capable of being moved from end to end thereof, without removing the frame from the timber to be bored. And also the clamps for the purpose of holding the frame to the timber."

41. For *Wheels for Rail-road Cars and Locomotives*; James Stimpson, city of Baltimore, October 23.

These wheels are to be made wholly of wrought iron, with the exception of the nave, or hub. The spokes are to be equal in width to the rim of the wheel, and they are to have a rib on each side, so that a transverse section of them will be in the form of a †; they are to be made by rolling, and are to be laid in the flask in which the hub is moulded, so that their inner ends shall be embraced by it; their outer ends being so formed as to adapt them to the rim. The tread and flanch forming the exterior of the rim, are to be of the usual shape; upon its interior there are to be two projections, one of which at about the middle part of the rim, may constitute a fillet of half, or five-eighths of, an inch thickness and rise, and the other a flanch, projecting inwards, on the side opposite to that on the tread. These are intended to strengthen the rim, without the necessity of using a large portion of metal.

The rims are to be made by rolling, which it is intended to do with such accuracy as to obviate the necessity of turning them. The ends of the spokes, and the interior of the rim, being properly adapted to each other, the latter is to be heated and placed on the former, when, by its contraction in cooling, the two parts will, by means of notches, or recesses, become firmly united, without the necessity of bolts, or screws.

The claim is to "the internal flanches, or ribs, within the internal periphery of the rim of the wheel, and the form, and mode, of fitting the spokes, so as to connect them and the rim together without screw-bolts, or rivets."

We have no doubt of the possibility of making wheels in the way above pointed out, or of their goodness when made; but we have at present no works for rolling edge rails, for rail-roads, nor are we likely to be able to compete with the English in this manufacture, for some time to come; yet the rolling of them could be more readily accomplished than that of the rims in question; we apprehend, therefore, that there is but little prospect of seeing the foregoing plan experimentally tested, on this side of the Atlantic, in time to reward the inventor, and to repay the expense of his labour.

42. For a *Machine for Making or Turning Horse Shoes*; Elisha Tolles, Winchester, Litchfield county, Connecticut, October 24.

(See specification.)

43. For an *Acoustic Drum, or Membrane, for Conveying Sounds*; Samuel Sawyer, city of Boston, October 24.

The invention here claimed consists in the application of some thin membrane, such as parchment, bladder, gum elastic, or other suitable material, over one or both ends of a tube, pipe, or hose, so as to make it perfectly air tight, and still to admit of the free passage of sound. Judging from the general tenor of the specification, it would appear that the application of this contrivance to the diving bell, and diving dresses, was that principally contemplated by the patentee. When used for this purpose, he proposes to place a valve, or valves, in the tube, or hose, which would be closed by the rushing up of air, in case the membrane should become ruptured, although at other times it would remain open.

The patentee says that "by the application and use of said drums, or membranes, and the valve, or valves, in connection therewith, I am enabled to supply, by means of a forcing pump, all such quantities of fresh air as the explorers under water may require, through the same pipe, tube, or hose, which conveys the sound, and thus dispense with all other tubes and pipes and conductors, and thus render the apparatus for exploring under water more simple and less expensive.

"And also by compressing the air into a tube, tubes, or conductors of sound through the air, furnished with my said drum, or membrane, the articulation of sounds is rendered more perfect, and can be extended to a much greater distance than has yet been practised.

"Notwithstanding all that is hereinbefore described, my whole invention consists in the construction of a drum, or membrane, of suitable materials, nicely fitted, adjusted, and applied, to all tubes, hose, pipes, and conductors of sound, either in the air or in water, for the purpose of conveying sounds, and articulating words, and holding conversations;—and in the application of a safety valve in connexion with said drum, or membrane, as is hereinbefore described."

There is not any drawing accompanying the specification of this patent, and it certainly is one of those things which would "admit of drawings," and in this case, the law imperatively declares that they shall be made. It is of no use to say that the thing can be understood well enough without them; the law leaves no discretionary power respecting it. The drawings ought to have represented how the valve alluded to should be constructed, so as to render it sufficiently sensible to insure its action. It is not enough to say that there must be a "safety valve;" steam engines have safety valves, but, we apprehend, not of a kind to suit the hose, or tube, in question.

44. For an improvement in the common *Riding Saddle*; Alonzo R. Dinsmoor, Goffstown, Hillsborough county, New Hampshire, October 25.

The covering of the seat of this saddle is to be in one entire piece, and drawn on whole; small jockeys are to extend back and cover the stirrup loops, and these are to be nailed on, the nails being covered

by a flat moulding; near the jockeys there are to be small pads. "The above are claimed as improvements, and are more fully represented in the *model*." The patentee adds, "The advantages of saddles constructed in this manner are, that they are more durable, easier to ride upon, and, by saving labour and stock, consequently cheaper." The foregoing contains nearly the whole specification.

45. For *Boilers for Generating Steam*; (No. 1) John Goulding, Dedham, Norfolk county, Massachusetts, October 25.

This is to be a vertical, cylindrical boiler, the furnace and ash pit of which are situated at its lower end, much in the manner of the ordinary cylindrical stove. There are to be two interior cylinders concentric with that which forms the exterior of the boiler, but which are to terminate at some distance below its upper end; these two cylinders are to be connected together by a covering close at top, but not passing over the inner cylinder, as the water to be heated is contained between the outer and second cylinder, and is to flow over into the interior cylinder, which is closed at its lower termination over the fire. The flame and heat from the fuel pass up through the space between the interior cylinders, and the smoke escapes through pipes attached to the plate which closes their upper ends. A great number of tubes, open at each end, cross the space between these two cylinders, opening a free passage between the interior of the inner cylinder, and the space between the outer and second cylinders. These tubes are arranged spirally, so that one shall not directly cover another, and obstruct the general action of the heat from the fire.

In the specification, certain proportionate dimensions are given, but as these are not essential to the principle, we need not insert them, nor is it necessary to describe those subordinate parts, or modes of connexion, the necessity for which will be understood by those interested in the subject. These are all perfectly well represented in the drawings accompanying the specification, leaving nothing to desire in this particular.

The claim is to "the arrangement and combination of the second cylinder, with a third cylinder, and the pipes between them; all being placed within an outer case or cylinder; and for said arrangement and combination I herein claim letters patent."

The boiler given as an example has the outer cylinder six feet high, and two feet six inches in diameter. The second cylinder is four feet in height, and two feet three inches in diameter, its bottom reaching within about five inches of the bottom of the outer cylinder, and being supported upon legs. The inner cylinder is two feet three inches long, and six and a half inches in diameter, its top edge being, of course, even with the top edge of the second cylinder. The smoke pipes ascend from the covering of the two inner cylinders, and pass through the top of the boiler.

In the great variety of forms which have been given to steam boilers, there are some which, in part, resemble that before us; we think, however, that it possesses enough of novelty to sustain a pat-

ent. Whether the circulation of water within it will be such as to prevent incrustation in the tubes, and to obviate other difficulties which have been encountered in the employment of tubular boilers, is a question that must be decided by the test of experience; we know that a favourable opinion is entertained respecting them by some persons of judgment, and we hope that this opinion may be found to be correct.

46. For *Boilers for Generating Steam*; (No. 2) John Goulding, Dedham, Norfolk county, Massachusetts, October 25.

The specification of this patent describes the same boiler with that which precedes it, and is, nearly throughout, couched in precisely the same terms. The only difference in the construction of the boiler, claimed in the present instance, is a pipe, or tube, attached to the upper end of the inner cylinder of the boiler, and bent into a semicircular form, so as to pass through the outer cylinder near its upper end; its semicircular form causes its mouth, or opening, outside of the boiler, to be downwards, and this is to dip under "water in an evaporator to prevent evaporation in the boiler. The under side of the curved pipe, or cylinder, should be a little higher than the surface of the fluid in the boiler. The fluid, by the act of ebullition, will flow through the pipe outwards; and it may afterwards be returned into the boiler, near the bottom, for reheating."

Although not very clearly expressed, it appears as though this curved tube is intended to prevent the rise of water into the steam pipe, in case of its too rapid ebullition; but for whatever purpose it is designed, we are unable to divine any reason for making it the subject of a separate patent; we think that it would have been proper to have included it with the other parts, in the former specification, as a mere variation in the mode of construction, it being nothing more than this; the patentee, however, has preferred another course, and, probably, may have good reason for so doing. The following is the claim:—

"That part of the above described boiler, which I herein claim as my improvement, and for which I now claim letters patent, is the extension of the [curved] cylinder over the head, or plate, [which unites the two inner cylinders,] and through the outside of the [outer] cylinder, so that the water, or other fluid, when raised above a boiling heat, may be thrown out of the boiler by its own ebullition."

47. For *Making Dry Steam*, or preventing water from passing or going over, out of a Boiler into a Steam Pipe; John Goulding, Dedham, Norfolk county, Massachusetts, October 25.

A wisp, tangle, or irregular coil, of small wire, is to be placed in the steam chamber, or rather, we presume, in the steam pipe, so as to occupy six or eight inches of its lower part; or layers of woven wire, or other similar substance, may be substituted for the wisp of wire, although the latter is deemed the best. The doing this is the thing claimed.

48. For an improvement in *Valves for Steam Engines*; Thos. B. Stillman, city of New York, October 30.

The object proposed to be attained by this invention, "is to combine the common slide steam valve, with a cut off valve, so that both may be operated by the same eccentric, or cam, upon the same seat, and each retain its distinctive character, for the particular purposes of a steam and cut off valve."

Without a drawing we shall not attempt to explain the particular arrangement of this combined valve, the purpose of which is shown in the above quotation.

49. For a *Rail-road Car to be Propelled by Animal Power*; Daniel W. Crocker, city of Philadelphia, October 30.

This is such a car as has frequently been described both here and in England, and has been essayed in both countries. The horse, or horses, by the power of which it is to be propelled, are to be placed in the car, on a movable floor, forming an endless chain, which passes over suitable drums, geared to the wheels which run upon the track.

The claim is to "the construction of the self-supporting chain; the double safety journals, and the arrangement of the several parts."

We have no objection to the name of the "self-supporting chain," because we believe that it will support itself; although we believe also, most firmly, that it will soon fail under the additional weight of the horse. The safety journals, so called, are formed by giving two different diameters to each end of the journals which sustain the drums, the smaller diameter running in a proper box, or bearing, and the larger diameter nearly touching a second bearing in the same box; the object of which is to sustain the shaft should the small end of the journal break off.

We are not able to discover in what respect this car is superior to those which have been already tried, if its superiority depends upon the things claimed; as we believe that one of these will not answer the intended purpose, and as the other has nothing to do with the general action of the machine, we expect but little from it.

If our readers will turn to vol. v. p. 296, they will find that such a carriage has not only been patented, but that among the things claimed in said patent, is the placing of horses in such a carriage, so that "they can travel in and upon the said carriage, either upon roads or railways, and by so doing, impart a power to move said carriage with accelerated or diminished speed, compared with that of the actual travel of the animals." It will be found also, that the thing was not then new, but had been repeatedly proposed. Mr. Stimpson, who was the patentee, had such a carriage constructed, which he used, in numerous trips, on the Baltimore and Ohio Railroad; one of which trips was rendered memorable by the car running over and killing a cow, and being overturned, nearly proving fatal to some of the passengers. We mention this not as a fault peculiar to this kind of car, but merely as an event in its history, and in proof of

its existence. As Mr. Stimpson has essayed the contrivance, and appears to have given it up, we presume that he will not involve himself in law for the maintenance of his claim.

50. For *Locomotive Cars for Railways*; John R. Sleeper, city of Philadelphia, October 30.

This is called an "Accelerating Horse Power Locomotive," and is, in its general construction and object, similar to the machine last described; dependence, however, is placed upon what is esteemed an improvement, as will be seen by the claim, which is to "the arrangement by which the motion of the car may be accelerated, retarded, or thrown out of gear, at will; the animal not necessarily altering his velocity." The apparatus for making these changes is described in very general terms, such as would not enable a person to carry the particular arrangement in the mind of the patentee into effect; and although every competent machinist can devise methods of his own for effecting the purpose intended, the thing ought not to have been so left.

To show that this idea is not new, we again quote from Mr. Stimpson's claim, the following sentence: "I also claim the application of the great principle, whereby a variation, more or less, is effected without varying that of the animals, as hereinbefore described."

51. For an improved *Piston and Valve, &c. for Steam Engines*; Samuel Hall, Bassford, Nottingham county, England. Issued in pursuance of a special act of Congress, passed March 2, 1833. October 30.

In vol. xiii., p. 329, there is a notice of a patent granted to the same gentleman to whom that named in the caption, has issued. It now appears that some mistake was made by the agent employed in obtaining the former patent, which will, probably, be remedied by the one before us. The specification is of considerable length, but we can afford room for a very abridged account of it only. The whole title is "An improved Piston and Valve for Steam, Gas, and other Engines. Also, an improved method of lubricating the Pistons, Piston Rods, and Valves, or Cocks, of such Engines, and of condensing the Steam, and supplying Water to the bodies of such Steam Engines as are wrought by a Vacuum produced by condensation." This, it will be seen, is precisely the same title with that formerly noticed.

The improved Piston is so constructed, that, by the pressure of steam on either of its sides, the packing is forced into closer contact with the sides of the cylinder.

The improved Valve consists of two parts; first the sliding part, called the sliding frame; and secondly, a plate on which it works, called the seat plate. The former is made so that each side and end, or other part of the face, shall have its separate bearings on the latter, independently of the others.

The improved method of Lubricating consists in effecting, by a circuitous route through the valves, or cocks, working cylinders, and

other parts of steam and other engines, the separation of the oil, or lubricating matter, from the elastic or non-elastic fluids on their quitting such engines in commixture with each other, in order that the lubricating matter may be again employed for the same purpose.

The improved method of Condensing, is by means of a peculiar application of metallic surfaces, in conjunction with water, in a way particularly described. This part applies only to engines worked by means of a vacuum, which is the general plan in England, though not with us. The object of the arrangement is to cause the water resulting from the condensation of steam, to become itself the internal condensing water, and which is afterwards conducted again into the boiler, separated, as before mentioned, from the lubricating matter.

The apparatus by which these ends are attained, is fully represented in the drawings, and explained in the specification; the report of the English engineers who have examined and tested the invention, has been altogether approbatory; it is probable, however, that the whole may not prove as generally applicable in this country, as it has there; there are, however, parts of the plan which suit high, as well as low, pressure engines.

52. For *Improvements in the Steam Engine*; Samuel Hall. Issued as the foregoing. October 30.

This patent is taken for improvements upon the modes of procedure, and the manner of construction, originally adopted by the patentee. He says: "The objects of my present invention, (which invention I confine to steam engines worked by a vacuum produced by condensation) are to condense, without injection of water, (for the purpose of creating as good a vacuum as is obtained and well known in injection engines,) the steam which passes through the engine for the working thereof; and also to condense for the most part, (if not wholly) that portion of steam which usually escapes through the safety valves into the atmosphere, when the pressure of the steam in the boiler is too high during the working of the engine, in order that the water resulting from the condensation of such steam may be returned into the boiler, and also further to supply so much more distilled water to the boilers of the above mentioned description of engines as is required to supply and replace any waste that may take place in the working thereof, in order to avoid the introduction of any water into the boiler, containing saline or other extraneous matters."

If we could with convenience present the illustrations of the plans of the patentee, contained in his drawings, we would gladly do so, but, as in the previous patent, we apprehend that the contrivances explained in this, will but rarely apply to our engines; as even those which we denominate low pressure, or condensing, are usually of a mongrel character, working under a force of steam, at least equal to double the pressure of the atmosphere.

53. For a *Conical Grinder for Grain*; Daniel and John Fitzgerald, city of New York, October 31.

This apparatus, in its working part, is similar in form and operation to other machines already in use for grinding grain. It consists of a conical stone running within two halves of a hollow cone of the same material, but these segments of a hollow cone are to be placed within a cast iron conical case, cast in two parts, to receive them. The claim is to "the manner of confining the concave stones in the case, and hanging the same, being on an angle of about forty-five degrees; with the shape and form of the case, and the manner of placing the hopper on the case."

54. For a *Thrashing Machine*; John and Daniel Fitzgerald, city of New York, October 31.

The patentees claim "the form of the bearers; the ridges in the concave, and the form of the hoops and beaters attached to them."

As an example of the things invented on the present occasion, we give the description of the bearers. "The bearers to support the machine consist of cast iron plates, one foot and four inches in diameter, and half an inch thick, with a flanch round the edges projecting out one inch, and a projection on the lower parts forming the *pedsills*."

55. For a *Truss for the Cure of Hernia*; John L. Price, Nicholasville, Jessamine county, Kentucky, October 31.

Instead of a pad of the ordinary construction, a plano-convex ball of lead, the convexity terminating in an obtuse apex, is to be fixed to a belt which is to surround the body; the apex of the leaden ball passing into the ruptured cavity.

The manner of making and using the strap is described and figured, but there is not any claim made. Lead is the only article spoken of as employed to produce the pressure, but why the same mechanical effect should not be produced by other articles, it would not be easy to tell. We presume that the intention of this pad is to produce irritation, and adhesive inflammation; if so, it ought to be applied under the direction of a skilful surgeon, or it may produce much more harm than good.

56. For an improvement in *Bedsteads*; Ezra Coleman, New Bedford, Massachusetts, October 31.

This "newly invented or discovered bedstead," will probably be rediscovered, or reinvented, by numerous discoverers or inventors now unborn, or who have not yet entered the lists. There are but few inventions which have been so repeatedly presented at the patent office for the first time; the reason, we suppose, is, because the contrivance is so obvious, that little, or no, inventive genius has been necessary to call it forth. The rails are to be furnished, at their opposite ends, with a right and a left handed screw, to which female screws in the posts are to be adapted.

After all the trials which have been made of this plan, its value has not been such, it seems, as to have made it generally known, no doubt because, in practice, it is a very defective affair, it being nearly impossible to make the two screws coincide, so that they shall both come to a shoulder at precisely the right place; but were the plan good, the patent would be of no value, as the thing belongs to the public.

57. For a machine for *Shelling Corn*; Rodney Hoit, Miamisburg, Miami county, Ohio, October 31.

This corn shelling machine is more complex than the one first patented, thirty years ago, (see also No. 16,) but does not differ from it in its general construction and mode of action. A cylinder, with teeth upon its surface, is made to revolve within an adjustable concave. The cylinder is to be turned by a winch having a cog wheel on its shaft, which cog wheel takes into a pinion on the cylinder shaft, represented in the drawing, as of about one-fourth the size of the cog wheel. A riddle is placed beneath the cylinder, as has frequently been done in other machines for the same purpose, and there is, also, a cover placed over it. The cylinder and concave are each to be of cast iron, the former a foot in length, and seventeen and a half inches in diameter. To form it, staves, properly adapted to the purpose, are to be screwed upon wooden heads. The claims are to "the concave in which the cylinder works; the cylinder as formed with the metal surface, giving it the properties of a fly wheel; the form of the teeth on the concave; the spring of steel, or elastic wood," &c. &c. &c. We have already indicated the want of novelty in the general construction; this, it is true, is not claimed, but several particular parts which are so, have been previously employed for the same purpose.

SPECIFICATIONS OF AMERICAN PATENTS.

Description of a Gas Metre, for which a patent was obtained by JAMES BOGARDUS, of the city of New York, October 7th, 1834.

The gas metre described in the specification attached to this patent, differs in its principle of action from all those which have preceded it, or, at all events, from those which have come to our knowledge. Its exterior form is that of an oval shade, such as are put over time pieces, the longest diameter of which is about nine inches, its shortest six or seven, and its height fourteen. This exterior part is to be made of cast iron, in two pieces, being divided by a vertical plane passing through its longer diameter, flanches being cast along its edges, to allow the two halves to be united by means of screws; this vessel has a bottom, so as to form a perfectly close box, and it stands upon short feet. On the front side of it there is an opening, formed in the casting, which is filled with glass, cemented in, air tight, and

affording a view of the index, and of the general operation of the machinery contained in the interior. In the lower part of this case there are two openings, one for the introduction of the gas from the reservoir, and another to allow of its exit to supply the burners.

We shall not attempt to describe specifically the construction of the interior, but merely to make known the general principles upon which the indications of this instrument depend. When the two shells are put together by their flanches, they are made to embrace a flexible diaphragm, of bladder, or air tight cloth, which is loose, or bagging, in the interior, so that when gas is forced in on one side, the diaphragm will pass over to the other, and come into contact, or nearly so, with the shell. The induction and exit apertures above spoken of, are connected with pipes, which are cast on to the bottom, and are so constructed that they can communicate with either side of the diaphragm, there being a movable cup, or cover, which is shifted at every vibration, thus producing an effect resembling that of the slide valve of a steam engine. The diaphragm, of which we have spoken, is in part embraced between plates of sheet tin, leaving its edges and upper part free to obey the pressure of the gas admitted; this sheet tin works on pivots at the lower end, and can, consequently, vibrate backward and forward with the diaphragm.

When the gas is admitted on one side, that on the other is forced out, by the action of the diaphragm upon it, and this, at the end of its vibration, reverses the communications between the induction and exit pipes, causing the gas to be admitted, and discharged, from the opposite sides. The same vibrating diaphragm acts also upon the wheel work by which the indices are moved, which point out the quantity of gas which has passed, by counting the vibrations, as one must necessarily be a measure of the other. The arrangement of the moving parts, as described in the specification, appears to be both simple and efficient; but it is to be considered as nothing more than an exemplification of the means by which the principles adopted may be carried into operation, but not limiting it thereto, as will fully appear by the extracts which we are about to furnish.

“The applicant proceeds, in the next place, to describe the principle of his invention. This principle consists in the action of a movable partition enclosed in an air tight vessel constructed substantially as aforesaid, and moved from side to side of said vessel by the current of gas acting in the vessel, successively on one side and on the other of this partition, by means of any machinery constructed in combination with said partition, substantially as aforesaid. This alternate action of the gas being effected by the action of the gas upon the partition, and the machinery combined with it, and moved and timed by the motions of the partition as aforesaid; the number of its operations being marked by an index combined with said partition, and moved by its motion, and so timed thereby, and by means of connecting machinery, as to indicate, with perfect certainty, the number of full or complete operations of the partition; the space through or in which the partition moves from side to side within the vessel, being, in fact,

the measure of the volume of gas which passes through the vessel at each full operation of said partition forward and back.

"But the applicant further describing the principle of his invention, observes, that the diaphragm may be varied much in its form, and in its points of support and action, and the cup may be varied in its form, or instead thereof, a sliding valve may be used, or a four-way-cock, or other valvular construction, with machinery respectively adapted thereto, may be used, to change the direction of the gas from side to side of the diaphragm, and any convenient machinery may be used to time the action of the cup, or valve, and of the index, and yet the mode of operation for measuring gas will be identical with the principle of this invention, if, in fact, there be within an air tight vessel a partition moved by the passing current of gas which acts alternately on its sides, by means of machinery moved and timed by the motion of said partition, and if the number of the movements of the said partition be indicated by machinery moved and timed by the motion of said partition, substantially as aforesaid.

"The applicant contemplates the application of this instrument to current water in all aqueducts, where, as in the use of gas, the quantity of water used or delivered, is to be ascertained. He contemplates the use of it, also, to the discovery of leaks in gas pipes, and in water pipes laid in the ground. This applicant also contemplates the use of this instrument to the measurement of wines and liquors, when running into hogsheads, and casks, and barrels, by combining an instrument constructed on this principle with a syphon.

"These are some of the modifications of its use, and there are obviously other applications of this principle, analagous to them; but those above mentioned sufficiently indicate the extent and variety of its applicability."

Specification of a patent for a machine for making or turning Horse Shoes. Granted to ELISHA TOLLES, Winchester, Litchfield county, Connecticut, October 24th, 1834.

Know all men by these presents, that I, Elisha Tolles, of Winchester, in the county of Litchfield, and state of Connecticut, have invented a new and useful machine for turning or making horse shoes, and that the following is a full and exact description thereof.

I make a bench of wood, or iron, or of the two combined, of sufficient strength to support the machinery, and sustain the pressure necessary to the operation to be performed. This bench has two parallel cheeks, placed at a distance of six or eight inches from each other, and of such length as may be necessary, say five or six feet. Between these cheeks, at what I will call the hind end of the machine, a sliding piece works backwards and forwards in grooves, being carried by a pitman attached to any sufficient motive power. This slide forms the bed upon which the piece of iron to form the shoe, is received and sustained, during the whole operation. On the

end of this slide, opposite to that to which the pitman is attached, a piece of iron rises, which is to give the form to the inner curve of the shoe. The end of this piece, which first comes into contact with the bar of iron, is rounded, and its sides are straight, the curving in of the hind or corked end of the shoe being given after its delivery from the machine. The bar of iron, of which the shoe is to be formed, being selected of a suitable size, and heated in a forge or furnace, is placed crosswise upon the bench, and just in front of the *former* on the slide, the latter being retracted. On the under side of the slide, there is a rack, which takes into a toothed wheel, upon a shaft crossing the hind end of the machine; this shaft carries cams, which act upon two levers, serving the purpose of shears to cut off the bar, and of stops to gauge it. When one of these levers is up, the other is down; and as bars are fed alternately from each side of the machine, a bar is passed under the raised end of one lever, and is stopped against the depressed end of the other; the slide then advancing, the raised lever, or shear, is depressed by the action of one of the cams, and the bar is cut off by it, the part of the bed immediately under it, forming the other edge of the shear. The piece thus cut off, is carried forward by the curved end of the slide to be turned, or formed into a shoe, its middle bearing against the beforenamed piece on the slide. At this moment, its two ends come into contact with two segment dies, working horizontally upon strong centres on the bench. The edges of these dies are so formed as to embrace the bar between them and the projecting piece upon the slide, giving the proper width to the shoe, and the proper shape to its outer edge.

As the slide advances, the bar to form the shoe is carried under another segmental die, vibrating upon gudgeons between two standards, which rise vertically from the bench.

The under side or face of this die, is so formed as to groove, punch, and give the entire shape to the outer surface of the shoe, whilst the bed of the slide upon which it rests, shapes the part which is to come into contact with the hoof. At the moment the slide comes into contact with the last mentioned, or vertical die, teeth upon each edge of the slide engage with corresponding teeth on the die, and they are thus made to act in perfect concert with each other. When the lateral dies act no longer on the bar, they are returned to their places by the action of springs, or weights, and as the slide returns, the hind end of the shoe, touching against them, is pushed off from the bed, and falls through between the cheeks of the bench. The vertical die is kept back against its bearing, so as to engage properly with the slide, by means of a weighted lever, spring, or otherwise. The drawing of this apparatus, deposited in the Patent Office, together with the written references thereunto annexed, will fully illustrate the construction and action of this machinery, and, as I believe, fully complies, in this respect, with the requirements of the patent law. I am aware that rollers, or parts of rollers, forming segment dies, have been used for forging, or giving form to various articles of iron; I do not, therefore, claim these, taken separately, or

alone, as of my invention; neither do I claim the cams, slide racks, or any of the other parts which I have described, in their individual characters; but what I do claim, and for which I ask a patent, is the general combination and arrangement of the several parts of this machine, as described, for effecting the purpose set forth, namely, the manufacturing of horse shoes; whether the said machine be constructed exactly in the manner described, or varied in any way which may be found expedient, whilst the general principle remains the same, and a similar result is obtained. ELISHA TOLLES.

TRANSLATIONS FROM FOREIGN JOURNALS.

On the Use of Anthracite in the Smelting Furnace of Vizille. By
M. ROBIN, *Director of the Neiderbrunn Works.**

(Continued from page 269.)

I omit the details of this working, the results of which were uncertain, in order to avoid repetition in speaking of the trials that followed, which, from the experience already had, were conducted with more regularity.

After the blowing machine had been repaired, the furnace was again put in blast, Jan. 19, 1828.

In order that the accidents which might happen during this new trial, should be attributable to anthracite alone, the charges were regulated so that the quantity of ore was always a little under that which the coal could carry, so as always to produce gray castings; other qualities of casting would indicate a derangement in the furnace. When the trials on the combustible were completed, it would be time enough to ascertain how much ore could be melted.

The composition of the charge was scarcely varied during the essays upon this coal; it was composed of nearly two-thirds of the rich, and one-third of the poor, ore, and sometimes, besides, a small quantity of flux, to improve the slag, or scull. The experiment soon showed what composition of slag was most proper to assure the good working of the furnace. Upon this point, no variation from the composition of the slag of the coke furnace could be admitted; 30 to 33 per cent. of lime, 15 to 20 of alumine and magnesia, and of oxide of manganese, the remainder silex, were the principal proportions, from which they could not vary without encountering difficulties.

With less than 30 per cent. of lime, the slag was viscous, or slimy, cementing together the ashes of the anthracite, and forming deposits in the hearth, as well as in the boshes. By surpassing this proportion, the excess of lime adhered to the furnace, and melted it; an excess of magnesia gave also a very refractory slag, and in the ore of Halles, could only be exceeded by great care.

Instead of putting the furnace in blast with pure coke, it was in-

* Translated for this Journal, by S. V. Merrick.

interesting to know whether this could be done with half coke, and half anthracite; proportions at which the first trials had been stopped. The expense of coke made the success of this experiment of great importance to the establishment, since the coke had to be transported seventy-two miles. They proceeded to put the fire to the furnace as follows, with the precautions employed in the coke furnace, and with care to proportion the blast to the density of the new combustible.

The furnace was half filled with coal; during the heating, that which was consumed was replaced successively with charges composed of 600 lbs. of coals, and a like weight of ore; that is, about two-thirds the usual full charge.

They operated thus during twenty-three days, and made twenty-two runs; at this time the ore arrived at the tuyeres. The blast was given by two opposite tuyeres, with openings, twenty-three lines in diameter; the pressure of the mercury gauge, which was at first very feeble, was soon raised to 20.7 lines: at the end of three days, the charges filled the furnace entirely. This manner of operating produced no satisfactory results; it was impossible to make the furnace work well, after six days of varied attempts.

The blast passed through the charge with difficulty; it reacted on the tuyeres, and had much trouble to maintain itself towards the tym; when it escaped from this part of the furnace, it projected the scoria with force beyond the boshes.

The charges descended slowly; the furnace was encumbered with anthracite, in dust, which checked the slag, otherwise scarce, from bathing and heating properly all parts below the boshes. The scoria was, besides, subject to the action of the blast, which reached also the metal, and rendered it so thick that it coagulated against the dam stone, from whence it was removed by pieces. To avoid this last inconvenience, a tuyere was opened opposite the tym, so as to re-heat the front part of the boshes, and also to assist the ascent of the blast. The pressure was raised gradually to 5 in. 2 lines; but all these efforts were fruitless.

The third tuyere was suppressed, as it only had the effect of paralyzing the blast of one of those from the side; the furnace became dark, and the blast often threw out the scoria and small coal. The scoria, generally well fused, became, from time to time, black; the first casting observed was white: on the second day it was mottled, which proved that the furnace worked better; but it soon returned to the first quality, and thus alternated during many days. As only 20 to 22 charges descended during twenty-four hours, the melted material arrived slowly at the boshes. It was only in the sixteenth day after putting on the blast, that a feeble run of white iron was obtained.

To be relieved from this state, recourse was had to pure coke, in order that the trials might recommence from this point. It is possible the success would have been better, if the furnace had been filled with coals before putting in the charge, and if they had charged

with a little more ore, when the blast was commenced, and in place of roasted mineral, in dust, employed the crude ore in pieces; coke about the tuyeres would have permitted the blast to pass gradually, till it arrived at the ore.

In this way all the column of material would have been heated, and the draught facilitated, and by adapting the material to the state of fusion, they would have avoided another difficulty, which they feared; that of destroying the furnace, by pushing it too fast.

At the arrival of the coke before the tuyeres, the furnace recovered itself as by enchantment, the draft became excellent, the charges doubled their rapidity; the scoria, perfectly fluid, became white, shaded with blue on the surface, and presented on analysis mere traces of oxide of iron.

The first running gave iron mottled, almost gray; the flame at the mouth, which before had been sombre and feeble, mounted suddenly, and acquired a beauty which is one of the characteristics of the coke furnace.

In order not to waste the coke, they placed two new mouths to the tuyere, of eighteen lines diameter, blowing with a pressure of four inches one line. In spite of that, they made forty-two charges in twenty-four hours. Soon the first tenth, then the second tenth, of anthracite, added to the coke, was passed; at this time the poor roasted ore was replaced by crude ore; no change was remarked in the working of the furnace. With three-tenths of anthracite, the dust of the anthracite began to show itself, and there was an evident relaxation in the descent of the charges; the blast returned past the tuyere.

With half coke and half anthracite, the same phenomena occurred. At this moment, in place of the rich roasted ore, one-half of the same ore unroasted, or crude, was substituted; this alteration made no change towards a more perfect working of the furnace; they had now arrived at the point where the first trials were stopped; the furnace worked as well as with the coke; the scoria did not change for an instant; the castings were very gray, had a fine grain, and a remarkable tenacity.

The first three-tenths of anthracite, which had not presented difficulties, were charged very quickly, and in less than thirteen days, one-half had been added.

As the matter which was to run down from this period was unknown, they stopped longer to judge of the effect produced by every new proportion of anthracite; six-tenths, however, passed as well as the lower proportions. The working of the furnace was very regular with seven-tenths, but the casting was slightly mottled towards the end of this essay; they succeeded without trouble to bring it back to the gray. The gray pig, at six-tenths and seven-tenths of anthracite, was a gray less deeply marked than that obtained before; the grain close, but less uniform. The moment mottled iron appeared, the scoria became white.

During the whole of these essays, this law was constantly remarked

in the scoria; that for the gray pig, it was blueish, and for the casting slightly mottled, or mottled gray, of a perfect white; of a clear brown for the casting of Welsh mottled, and deep brown, or black, for the white iron. This *last* was produced sometimes with scoria, of good colour; then the quality was due to a sort of refining which is received on the hearth, when the blast struck forcibly against the scoria, and reached the naked iron, or rather when the metal became refined by exposure to the blast above the tuyeres, by the too slow descent of the charge.

The working of the furnace, which till this time had been regular, changed with eight-tenths anthracite; the dust of the coal, which was already abundant, commenced to clog; the draught became sensibly more variable; the air was returned more forcibly by the tuyeres; the casting became mottled, then white, and having returned to mottle, changed again; the scoria assumed every shadow of colour, even to blue; the material became scarcely red at the furnace mouth, the flame became feeble, and the charges commenced to descend irregularly, often by sudden falls. The furnace was not difficult to manage in this state; but the attempts of every kind, made during nine days, to restore it to a good working order, were fruitless. They then charged with eight-tenths of anthracite, the same phenomena continuing to be manifested, in a still more decided manner. The descent of the charges was extraordinarily slow, the whole iron becoming clammy; their fracture, however, showing some mottled parts.

From these trials, it was easy to see that it would be impossible to make the furnace work with nine-tenths, or even eight-tenths, of anthracite; it was, however, decided that the experiments should be pushed to the extreme, in spite of all risks to the furnace; they therefore, during four days, charged with pure anthracite. When it took the place of the mixture, the labour, already so hard, was further augmented. They remarked, but in a more decided manner, the same accidents which occurred when the furnace was put in blast with half anthracite. The draught and flame at the mouth were almost extinct; the blast returned by the tymp, and by the tuyeres, throwing out frequently the scoria, the coal, and even the metal; this became so thick, that they were compelled to draw it out almost entire from the hearth, by blows.

It was only by raising the dam, stopping up the tymp with clay, and by making there, for two or three hours, holes which allowed the scoria and iron to run out together, that they were able to obtain some masses of iron, which together weighed a few hundred kilograms only.

The casting from the anthracite was of a grayish white, facettes very small, a little radiating; its surface was covered with small bubbles, proceeding from the effervescence which strong iron displays, when submitted to a refining. The fractures frequently showed hollows, which were coated with irised arborescences, like those often seen in native silver.

The scoria which accompanied the small runnings of iron were demivitrified, of a yellowish brown colour, and, of course, easily removed. Before the arrival at the tuyeres of the charges, containing seven-tenths of anthracite, which were worked after the pure anthracite, to restore the furnace to action, its situation grew worse, the little holes before spoken of, could not be continued a long time, because the half refined iron attached itself to the walls, and, in a great measure, choked the furnace. The progress of this new evil was arrested by making a hole as low as possible, by which the melted matters were allowed to run out during certain hours; from time to time these openings were closed, to maintain the heat in the upper part of the furnace.

On the arrival of the new charges below, the furnace soon recovered itself; but to get rid of the choking, they were obliged to return to pure coke.

It would be tedious to speak of all the means used to maintain the furnace in good working order. It will be sufficient to state that the pressure of the blast was carried, during two days, from 7 to 7.4 in., with two openings of 30 lines; whilst for the five-tenths of anthracite, they only employed tuyere irons of $2\frac{1}{2}$ lines opening, and with 4 in. $6\frac{1}{4}$ lines pressure; and for seven-tenths anthracite, the same tuyeres, with 5 in. $6\frac{1}{2}$ lines of pressure. As this enormous pressure given to the air was insufficient to carry it properly through the charge, it seemed probable that, if the column of material was curtailed in elevation, they could more readily obtain this effect. The charging was stopped till the burthen receded six feet, and then ten feet, below the mouth, but without success.

When the furnace was re-established by means of coke, they repassed in nine days, without meeting any accident, to a charge of seven-tenths anthracite, and stopped at this proportion, which was convenient for making some other essays, especially for finding the maximum of mineral which could be smelted under these circumstances. It was ascertained that they could produce grey metal, with charges composed of 200 of fuel to 310 of ore, (crude,) of which 100 was poor ore; but that beyond this limit, the iron became mottled. At this point they made twenty-one charges in twenty-four hours, and reduced only 3220 lbs. of metal, burning 2.60 of fuel to 1. of iron, and the ore yielded only 24.73 per cent. of metal. The furnace was difficult to manage. When the blast was urged, to hasten the descent of the charges, it did not pass through with sufficient ease, and part was lost at the tuyeres. It was thought that this inconvenience would disappear if the burthen had less height; and, for the third time in the course of these experiments, they allowed it to descend ten feet below the mouth.

This last attempt appeared to promise better results than the first essays, during which the furnace was already completely deranged; but the wind appeared to be thrown back as strongly, and the metal became white. The dust accumulated in the base of the furnace,

evidently opposed to the circulation of the air. The unexpected change in the quality of the iron arose, perhaps, from the circumstance that the material, spread upon a greater surface of the furnace, could not be properly heated; the flame being carried sometimes on one side, then on the other, left a part of the furnace to cool. It is probable that, in a furnace of thirty feet, with dimensions proportioned to this height, they would have obtained gray iron; but that would not have enabled the air to penetrate more readily.

The poor ore, charged in the proportion of one-third, was replaced by the rich; but by means of this new treatment, the furnace did not produce sufficient scoria, the work became dry, and the metal clammy. The roasted ore offered some difficulties, being in small pieces; they endeavoured to cement them with clay, to pass them in the state of bricks; but in this form they had not sufficient resistance, and would have been crushed in the furnace. Bricks of ore and quick lime presented the same inconvenience, and it was only with a proportion of lime too strong for fusion, that they could obtain sufficiently solid bricks; moreover as, in winter, they hardened slowly, this operation would have been impracticable.

No expedient could then be found to augment this feeble yield; whilst with pure coke, using the roasted mineral, producing only 38 per cent., and without pushing the blast beyond the degree indicated above, they burned 20,500 lbs. of coke by day, and obtained 120.74 lbs. of castings during the same time, using an equal weight of ore. As 620 lbs. of crude ore was the limit at which it was necessary to stop with seven-tenths anthracite, and 400 lbs. of pure coke had borne 636 lbs. of roasted ore, which required, without doubt, more heat for its reduction than a material containing much carbonic acid, it must be admitted that the coke can reduce more ore than the other coal. Besides, we have seen the castings approach to whiteness with each new proportion of anthracite. This effect must be attributed either to the nature of this combustible, or to the difficulty with which its dust permits the circulation of the quantity of air required to raise the temperature high enough. This is a doubtful point, which it is not possible to clear up.

On recommencing with the coke, after the derangement by the anthracite, an entire identity between all the phenomena which happened before and after this operation, was observed. The following table indicates the quantity of fuel burnt each twenty-four hours, with pure coke, and with different proportions of anthracite; it gives an idea of the slackening of the yield of the furnace, according as this proportion was increased. The anomaly which is remarked from the three-tenths and four-tenths of anthracite, occurs because they suppressed for the less proportion, a part of the roasted ore, as indicated above; from this time, the charges were reduced a little faster.

Proportions of Anthracite. Coke & Anth. burned in 24 h's.

.0	.	.	.	10,250 kilograms.
.1	.	.	.	9,750 "
.2	.	.	.	8,780 "
.3	.	.	.	6,500 "
.4	.	.	.	7,250 "
.5	.	.	.	6,250 "
.6	.	.	.	5,250 "
.7	.	.	.	4,200 "
.8	.	.	.	3,750 "
.9	.	.	.	3,250 "
.10	.	.	.	2,500 "

The pig iron produced with the different proportions of anthracite were of good quality; made with a slight excess of combustible, they were very desirable for castings, because of their great tenacity; the others give, by the English method of refining, good iron. This result deserves to be mentioned, because, from the great quantity of pyrites contained in anthracite, sulphurous castings were to have been expected. This inconvenience has always been avoided when the proper proportion of lime was in the scoria.

The carbonates of iron, themselves, furnish to the scoria oxide of manganese, of which the base has a great affinity for sulphur. The scoria of the anthracite, pure, yielded on analysis, 1.96 per 100 of sulphur; the other scoria from five-tenths anthracite, contained 1.20.

The pig iron will then cost the following:

Casting from coke,	24.83 francs.
Those of .1 anthracite,	23.50 "
" .5 "	22.87 "
" .7 "	27.91 "

The smelting with half of each combustible was the least disadvantageous; with more coke, the cost of the castings increased, because of the increased price of this fuel. By employing, on the contrary, the greater proportion of anthracite, the general expense was increased, by reason of the diminished daily yield of the furnace.

The fusion of the carbonate of iron, by means of pure anthracite, has been resolved, scientifically speaking, at the foundry of Vizille. This operation has, however, been executed with great difficulty.

The establishment would have been able to proceed conveniently with the anthracite, in the proportion of five-tenths; but the company who attempted it, renounced the undertaking at the time when the iron trade, and more particularly the works using the English methods, were at a crisis which, even now, has not in many of them passed.

REPORT

To the Board of Directors of Bridges, Public Roads, and Mines, upon the Use of Heated Air in the Iron Works of Scotland and England. By M. DUFRENOY, Engineer of Mines. Paris, 1834.

[Translated for this Journal, by S. V. Merrick.]

Continued from p. 275.

EMPLOYMENT OF HEATED AIR IN CUPOLAS.

There are now many cupolas, in which the combustion is sustained by a current of heated air. The little attention paid in England to the consumption of coal, which is spread so profusely over the whole country, has induced them to trouble themselves but rarely to weigh the quantity used in the cupolas. This circumstance prevents my verifying with certainty the advantages which result from this plan. I think, nevertheless, that it will be useful to show the few documents which I have collected on this subject. I will give also a description of two kinds of apparatus adapted to the tops of cupolas.

At the Tyne Iron works, already spoken of, near Newcastle, there are two cupolas worked with heated air. They are supplied by the same apparatus which heats the air for the smelting furnace. These cupolas are circular, five and a half feet high, thirty inches diameter in the clear, constructed with fire brick, encased in cast iron. They receive the air through two tuyeres, placed one over the other, each two inches and three-quarters in diameter. From one of the proprietors, I learn that the consumption of these cupolas is 280 lbs. coke for each ton of iron melted. Casting on an average, one ton per hour. These cupolas have been constructed since the introduction of the hot air plan.

At Wednesbury, in the works of Lloyd, Forster & Co., the cupolas are rectangular; about seven feet high, with a space in the clear, of thirty-six by thirty inches. The air is introduced by two tuyeres, three inches in diameter. They cast in these furnaces, one ton of metal per hour, each operation lasting twenty minutes, consuming 260 pounds of coke;—before the adoption of hot air, the ton of iron required 400 pounds of coke. The greatest influence produced in these furnaces by the hot air, is, the rapid reaction of the charges, the time having been reduced from forty to twenty minutes for a heat. At Wednesbury, the quintal of iron melted with cold air, consumed twenty pounds of coke: with the hot air, this is reduced to thirteen pounds.

Messrs. Cosle and Perdounet (*Annale des Mines*, 11 Série Vol. vi. p. 85,) indicate that the quantity of fuel consumed in the cupolas of Birmingham, Manchester, and Newcastle, averages twenty-five per cent. of the weight of metal melted. If we compare these proportions with the quantities now given, we see that since the adoption of the hot air plan, a saving has been effected of one-half in fuel, and other expenses in the second melting of the iron.

In most cases where the air intended to sustain combustion in the cupolas, is not furnished by the apparatus attached to smelting furnaces, they are in the habit of using the flame which escapes from the top, for heating that which it consumes. I here add a succinct description of two kinds of apparatus placed above the top for this purpose. They were constructed at the shop of Messrs. Jeffries & Patton, London.

The apparatus represented at Plate 3, figs. 19 and 20, consists of a series of pipes, *a a' a''*, disposed horizontally over the mouth, and communicating by elbow pipes, with two boxes, *b* and *b*, placed upon the vertical face of the cupola; the air passing from the blast engine arrives in the pipe, *c*, enters the compartment, *d*, in the box, *b*, passes into the pipe, *c'*, and the compartment, *d'*, in the box, *b*, following the direction indicated by the arrows, it arrives in *f*, whence it is divided for distribution between the two tuyeres—all parts being made of cast iron.

The second apparatus (Plate 3, figs. 17 and 18,) is composed of a series of vertical tubes, *a*, disposed in a circle round the wall of the mouth; these pipes are three inches diameter in the clear, communicating at the extremities with two rings, *A* and *A*, placed one on the top of the cupola, and the other above the vertical tubes, *a*. One large cylinder of sheet iron, envelopes on the outside, the whole of the tubes, and obliges the flame to circulate round them. The air from the blowing machine passes into the upper ring, *A*, by the pipe, *c*, fig. 18. It is then divided between the vertical pipes, *a a'*, and reunites in the lower ring, *A*. Finally it is distributed to the tuyeres by means of two vertical tubes, *d d'*. In the upper part of the tunnel head, and above the lower ring, an opening is made by which to charge the cupola. I have not seen this last apparatus in operation, but it appears to be preferable to that described first. The air must acquire a higher temperature, and encounter less resistance in its passage.

Employment of Heated Air in Refineries and Smith's Forges.

The use of heated air has been tried in the refining of iron, and in the forges to work it.

I have not had occasion to visit works where trials have been made in blowing the refineries with hot air, but I know that at the Janon forge, near St. Stephen, the results obtained by using this plan have been but slightly favourable to its introduction; the same experience has been had near Birmingham. The want of success of this plan in refineries does not invalidate the evidences of its advantages in the smelting furnace, which has been proved in so many instances.

This difference in the results of the use of heated air in the smelting furnace and the refinery, appears to show that the air operates upon different principles in the refining of metal and fusion of the ore.

I have stated, at the commencement of this Report, that the first trial of heated air was made by Mr. Neilson, on a smiths' forge, at the Glasgow Gas Works.

The air is heated by the same fire as the forge, by means of a double cast iron box, (Plate 3., fig. 21,) which forms the bottom of the forge fire. The air arriving by the tube F, passes into the bottom, D, of the box, and returns by the tuyere, E, after having traversed the compartments, H and H'. Mr. Neilson showed the operation of this apparatus by having several bars of iron, of different sizes, forged in my presence, so that I could judge of the effect produced. Not having seen comparative experiments, it is difficult for me to form a judgment of the advantages derived. I cannot, however, conceive that the feeble temperature which the air could acquire in the apparatus adapted to this forge, could have much influence upon the economy of the operation. I had the fire cleaned out, to see the exterior disposition of the apparatus, and at the same time to appreciate the time necessary for welding. The fire was then laid on, and in four minutes after lighted coal was placed on the forge, a bar of iron, one inch square, was heated to a white heat. In taking it from the fire, this bar shot forth brilliant scintillations, and the little scoria that covered it, ran in liquid drops. The bar, plunged in water, was still, after being immersed a minute, a dark red, but hot enough to be hammered. I have not been able to determine the quantity of fuel consumed; it varies according to the size of the bars to be worked. Mr. Neilson assures me that the consumption of fuel in this forge has been reduced one-third since it has been fed by hot air.

It appears that there are many smelting forges in which they have adopted this new plan.

Trials upon Heated Air in France.

For some months, the French iron masters have been attempting to introduce the hot air plan. M. Boignes, who has contributed so much to the improvement in the iron trade, by the construction of the fine forge, *à l'Anglaise*, of Tourchambault, (Nièvre) has also made essays in the employment of heated air. Many other works, those, for example, of *Vienne*, (Isère) of *La Voulte*, (Ardèche) and of *Riouperoux*, near Grenoble, have adopted the plan.

The apparatus constructed by M. Boignes, presents, as that of the Clyde Works, (Plate 2, figs. 1 and 2,) a long development of pipes; the furnace of Torteron, (Cher) to which he has applied this plan, is worked with a mixture of coke and charcoal.

The application of heated air at this furnace has not produced results as favourable as were expected; but the nature of the metal has completely changed; the white iron has become gray, and now this furnace produces iron of a quality suitable for the most delicate castings, and enters into competition with the English metal.

Fig. 15.

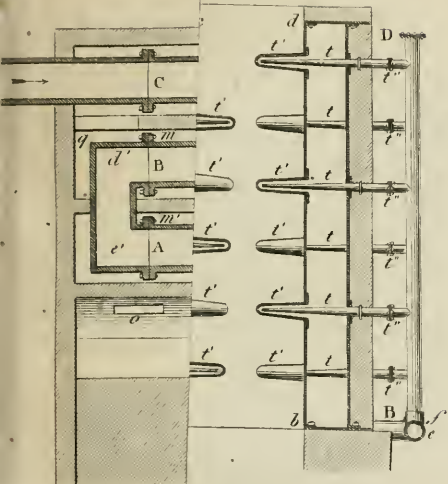


Fig. 17.

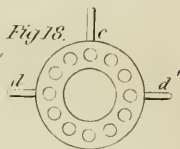
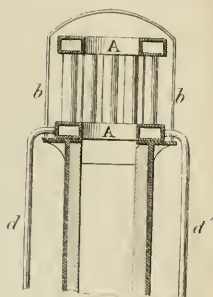
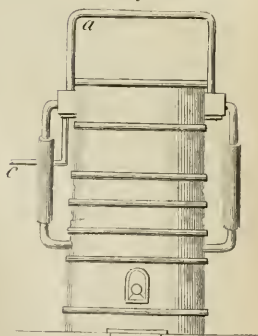
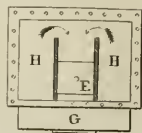


Fig. 19.



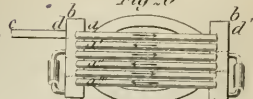
Elevation

Fig. 22.



Plan

Fig. 20.



Plan



When this metal is run into pigs, its grain is coarse, and the structure scaly, and very brilliant. The grain of this iron becomes much finer when cast into thin pieces, or founded a second time, and in this state it is remarkably soft under the chisel.

The furnace of Torteron has been in blast twenty-eight months, and works very regularly, the charges succeeding each other in equal intervals, and average forty-two or forty-four each twenty-four hours. Two species of ore are used—one called *mine froide*, is the true mineral *du Berry*, in small round grains, brown and slightly ochreous; the other, called *mine chaude*, is very argillaceous, being composed of grains disseminated in fine tenacious clay. The fuel used in this furnace is a mixture of charcoal, principally oak, and of coke brought from the collieries of St. Stephen.

I have not the data to determine precisely the saving effected by the use of heated air at the furnace of Torteron; but, for want of it, I compare the results obtained from two furnaces, the Torteron and the Guerche, (Cher) near each other, belonging to the same company, and the workings of which are analogous. I am indebted for these statements to M. Boignes, who has been kind enough to communicate them.

Consumption and Produce of the Furnace of Guerche, working with Cold Air.

Weeks.	Charcoal.	Coke.	Mineral.	Flux.	Iron produced.
	Kilogr ^{ms} .	K.	K.	K.	K.
24 to 30 Nov. 1833	33,320	16,800	101,500	22,400	41,524
1 to 7 Dec. “	34,510	17,400	99,000	22,400	40,460
8 to 14 “ “	33,320	16,800	93,000	22,400	38,430
	101,150	50,000	293,500	67,200	120,414
Coal for steam engine from 24 Nov. to 14 Dec. 335 hect. 95					

Consumption and Produce of the Torteron Furnace, worked with Heated Air.

Weeks.	Charcoal.	Coke.	Mineral.	Flux.	Iron produced.
	Kilogr ^{ms} .	K.	K.	K.	K.
24 to 30 Nov. 1833	38,528	20,640	129,000	44,720	46,969
1 to 7 Dec. “	34,384	18,420	115,125	39,910	40,607
8 to 14 “ “	35,504	19,020	122,675	39,625	43,307
	108,416	58,080	366,800	124,255	130,883
Coal for the steam engine, from 24 Nov. to 14 Dec. 364 hect. 69					
do. heating apparatus,				543	16

It follows from these tables, that for each ton of iron, (1000 kilogrammes) there is consumed,

	<i>The Guerche.</i>	<i>Torteron.*</i>
Charcoal, ...	833 kilogs.	828 kilogs.
Coke, ...	413	443
Mineral, ...	2437	2802
Flux, ...	558	949
Coal for the steam engine,	2.79 hectogs.	2.71 hectogs.
do. for heating apparatus,		4.15

The comparison which results from an examination of these numbers, is not favourable to the employment of heated air; but it should be stated that the operations of these furnaces are not in all respects comparable, because of the difference which exists between the materials employed. The ore used at the Guerche furnace yields forty-one per cent. of metal, while at Torteron the product is only thirty-five per cent. The quantity of flux added to the metal at Torteron is almost double that required at the other furnace. Notwithstanding these disadvantages, the daily produce of the Torteron furnace is greater than at the Guerche. If, then, instead of comparing the quantity of fuel consumed with the iron produced, we seek the relation between the ore melted and fuel, we find that the Torteron works operate with the greatest economy. In fact, in the Guerche furnace, 1000 kilogrammes of ore and flux require 419 kilogs. of fuel; while, at the other, 1000 kilogs. of the same mixture requires only 339 kilogs.

The use of heated air, then, at Torteron, presents a sufficiently marked economy; but an advantage which is quite as essential, is the improvement in the quality of the iron, which by this plan is rendered suitable for castings. This circumstance has enhanced its value at least twenty-five per cent. over the iron smelted with cold air.

Besides the furnace of which I have spoken, there is at Torteron, a cupola in which is used the apparatus for heating air, (Plate 3, figs. 19 and 20,) made in the workshop of Mr. Jeffries, of London.

I cannot state the advantages that result from the employment of heated air in this cupola, because I only know the consumption at this time. M. Boignes, who communicated these documents, shows that the new plan has produced but slight saving in fuel; but the principal advantage which results from it, is in accelerating the melting operation, the iron remaining a long time exposed to the blast.

This acceleration permits them to make many more castings in a given time.

* The blast engine at the Torteron furnace is sixteen horse power. The consumption of fuel has been augmented considerably since the introduction of heated air. This circumstance proves what we have already stated, that it requires a greater force to project the same quantity of air into the furnace when it is heated, than when cold.

Consumption of the Cupola at Torteron, worked with Heated Air, during six days.

1833	Consumption.		Product in Casting.		Consumption in Iron and Fuel to each 100 kilogs. of Casting.	
	Iron.	Coke.	Number of pieces.	Weight.	Iron.	Coke.
	Kil.	Kil.		Kil.	Kil.	Kil.
8 Dec.	2700	740	131	2460	108	30
9	3600	1070	246	3345	107	32
10	2550	710	135	2366	108	30
11	2650	740	139	2451	108	30
12	2600	720	126	2380	109	30
13	2400	680	117	2169	110	31
	16,500	4660	894	15,171	Mean 108	30

The employment of heated air, introduced into the furnace of Vienne eighteen months since, has effected a saving of nearly one-third in the fuel. M. Gueymard, in a report addressed to the Director General of Mines, &c., has stated that the consumption of coke, which was 250.87 ks. per 100 kilogrammes of iron produced with cold air, has been reduced to 146.24 ks. The expense of flux has also diminished nearly one-half; and the production, which was formerly 4,750 kils. of iron each twenty-four hours, has been increased to 5,988 kils. Since the report I have cited, Messrs. Cocq. Defourcy and Mont-marin, junior engineers of mines, have, by order of the director general, visited the Renne works. They have presented a memoir on this work, in which they give very circumstantial details in relation to the consumption of the furnace since the introduction of heated air. Their statements entirely confirm those given by M. Gueymard, and the details are worthy of record. The following is a literal extract from the memoir from which I quote:

Consumption and Produce of the Vienne Furnace, during the months of September, November, and December, 1832, and August, 1833.

Designation of month.	Coke for fusion.	Mixture and quantities of Mineral. (1)	Flux.	Coal for heating air.	Iron produced	No. of charg- es.
September, 1832. Cold air till 25th Heated air from 25th to 30th	K. 274,920	Ore of Voulte, 145,000 } do. Compte, 32,012 } do. Bujet, 39,700 }	K. 65,650	II. —	K. 90,869	1201
November, 1832. Heated air	241,696	do. Voulte, 262,112 } do. Bujet, 34,400 }	50,612	652	143,929	1016
December, 1832. Heated air	236,104	do. Voulte, 230,850 } do. Bujet, 14,525 }	54,562	644	122,298	1017
August, 1833. Heated air	218,391	do. Voulte, 166,974 } do. Bujet, 63,237 }	63,237	537	108,622	1015

(1) They work in the Vienne furnace, a mixture of ore from Voulte, Franche Compte, and Villebois or Bujet. The mineral from Voulte is a mixture of oolitic, iron ore and carbonate of iron.

The ore of Franche Compte comes from D'Autrey, and is a mineral in grains, yielding 35 to 28 per cent. The ore of Villebois, or Bujet, is very poor, composed of small oolitic grains, disseminated in chalk, which serves to diminish the quantity of flux required.

From these data the following table has been calculated, showing the quantities of coke, of ore, and of flux consumed at the different periods cited, to produce 100 kilogrammes of iron. The daily production of iron has also been added; and, to facilitate the comparison with the English works, the coke used has been transformed into crude coal. In this transformation we have considered the hectolitre of coal to weigh seventy-five kilogrammes, and have assumed the yield of coal to be fifty per cent. in coke.

Consumption to obtain 100 kilogrammes of Pig Iron.

	Ore.	Flux.	Coke for fusion.	Coal for heating air.	Total Coal.	Product of metal in 24 h'rs.	No. of charges in 24 h'rs.	Composition of charges.
1828	K.	K.	K.	Hect.	K.	K.		
Cold air	255.00	109.28	275.00	—	550.0	3500.00	51	{ Coke, 200 Mineral, 75 Flux, 75 }
Sept. 1832.								
Cold air	238.45	72.24	302.50	—	905.0	3028.90	40	{ Coke, 228.90 Mineral, 180.44 Flux, 54.66 }
Nov. 1832.								
Hot air	206.01	35.16	167.92	{ 0,453 or kil. }	369.8	4797.60	33.90	{ Coke, 237.88 Mineral, 291.84 Flux, 49.81 }
Dec. 1832.				{ 33.97 }				
Hot air	200.63	44.61	184.87	{ 0,526 or kil. }	409.4	3945.09	32.80	{ Coke, 252.15 Mineral, 241.27 Flux, 53.64 }
Aug. 1833				{ 39.45 }				
Hot air	211.93	58.21	201.05	{ 0,493 or kil. }	439.1	3503.92	32.72	{ Coke, 215.16 Mineral, 226.71 Flux, 62.30 }
				{ 36.47 }				

It appears from an examination of this table, that the month of November presents the most advantageous results, both as respects the quantity of iron produced and the consumption of mineral and of flux.

During this month, however, the metal was almost all white. The quantity of iron produced, must therefore be considered, rather than the quality.

During the month of August, the quantity of iron made, as well as

the consumption of material, was diminished; but the metal produced was of a superior quality.

The saving in expense resulting from the employment of heated air, has been, by comparing the products of 1828 (cold air being used) with the month of November, 1832, for each 100 kilog. of iron, 49 kilog. of mineral, 74.12 kilog. of flux, and 180.20 kilog. of coal; and the daily production of the furnace has been increased 1297.20 kilogrammes.

La Voulte Iron Works.—Since the month of September last, one of the three furnaces which compose this establishment, was worked with heated air.

The apparatus, constructed by Philip Taylor, civil engineer, consists of a horizontal pipe, 0.57 met. (22.4 inches) exterior diameter, and 43 metres (157½ feet) in length, having branches diverging to each tuyere. This pipe, which rests upon rollers, to prevent the inconvenience resulting from its expansion, and traverses the heaters placed near the tuyeres. The position of this furnace, placed only a few feet from an almost vertical escarpment, presented a great obstacle to the placing of this apparatus. Mr. Taylor has surmounted this difficulty, by constructing an arch, resting upon the escarpment, and upon the back wall of the furnace. The surface exposed to the action of the heat is 177,795 square metres,* (near 200 square yards.) The quantity of air injected through each tuyere is 500 cubic feet per minute.

Before the employment of heated air, seventy-two charges were passed through this furnace every twenty-four hours, each composed of—

230 kils. ore,	making per day	16,560 kils.
200 do. coke,	do. do.	14,400
60 do. flux,	do. do.	4,320

The average produce from this quantity was 7,000 kilog. of iron.

As soon as the heated air was applied to the furnace, the charges descended more slowly, and on the second day, twenty kilogs. were added to each charge. The next day, the working of the furnace being good, forty kilogs. were added to each charge. This second addition increased the rapidity with which the burthen descended, and seventy-six charges were passed in the same time. The scoria were very liquid, and bore all the marks of good working; the iron was of a crystalline structure, and a deep gray.

The two following days, the charges were again augmented forty kilogs., and Mr. Taylor, who had charge of the experiments, determined, as the iron was still too gray for puddling, to add twenty kilog. more of mineral.

* From some experiments made upon heaters of different forms, it appears that to raise the temperature of 100 cubic feet of air to 320° in each minute, requires that it shall traverse a surface of tube of one and one-third metres, heated to a low red heat.

The eighth day, seventy-six charges were passed, composed of—		
350 kilog. mineral, making, total		26,600 kilog.
200 do. coke, do.		15,200
60 do. flux, do.		4,560

The product being raised to 11,000 kilogs. of mottled gray iron. Afterwards, the number of charges was raised to eighty-four per day, and the produce of the furnace to 14,000 kilog. of iron. The fuel employed to heat the air, was 0.25 of fine coal or slack, to 1. of iron.

According to the report of the experiments made by Mr. Taylor at the establishment of La Voulte, by the employment of hot air, the result is, that to produce 1000 kilog. of iron, the consumption of coke has been reduced from 2,057 kilog. to 1,210, including the coal used to heat the apparatus, supposing it to be transformed into coke.

This establishment presents at once, under the same roof, one furnace working with heated air, and two working with cold air, under exactly similar circumstances. The results we have indicated, therefore, can be constantly made the subject of comparison.

At *Riouperoux*, in the department of Isere, M. Gueymard has obtained analogous results. The furnace that consumed, a short time ago, 1,610 kilogs. of charcoal per ton of iron produced, has reduced its consumption to 1,270 kilogs., by raising the air to 130° R., (280° Fahr.) not including the anthracite which is used to heat the apparatus. This result is important, as it is the first example of heated air having been applied to a charcoal furnace, and dispels the doubts of those who believed that the plan could not be adapted to this kind of fuel.

At *Wurtemberg*, the hot air plan has been recently introduced into the royal foundry of Wasseraffingen, and has effected a considerable saving in fuel. The quantity of charcoal there required to obtain 100 pounds of iron, has been reduced from 185 to 113 pounds, and the daily production has been raised from 7,530 pounds to 10,500.

The apparatus employed in this foundry to heat the air, is placed over the tunnel head, and no other fuel is found necessary.

(To be continued.)

Imitation of Bronze by Painting on Iron.

The vast quantity of cast-iron employed at the present time for common purposes, and the still increasing demand for them, have induced superintendents of the provincial forges to inquire of us the method of painting the metal, to give it that appearance of bronze observed in many utensils furnished by the ironmongers of Paris to their customers. The process is simple, and provincial manufacturers will find their interest in adopting it, by the advantageous sale of their merchandise.

When articles to be exposed to the air are to be bronzed, they are, in the first place, covered with one or two coats of yellow oil-paint, (ochre;) when these are dry, one or two coats of deep green oil-

paint are spread very evenly on them; as soon as the last paint is almost dry, but yet sticks, the raised surfaces are rubbed with a rough brush, filled with powdered yellow ochre, or stil de grain.* The powder adheres to the surfaces touched, and gives them a bronze tint; to increase the resemblance to the real article, the depressions and re-entering angles of ornaments, are retouched with verdigris, ground in oil; when completely dry, the articles are varnished.

More delicate articles, intended for the interior of houses, which should, of course, present a more perfect finish, are painted in the following manner. The yellow colour, which is to be used for the first coat, is ground quickly with spirits of turpentine, and added to copal varnish; this mixture is laid on with a flat badger brush; when the paint is dry, it is polished with pulverized pumice; the yellow and blue paints, in proportions proper to give the desired green tint, are ground in the same way, and laid on in successive layers, each coat being allowed to dry thoroughly; when the last coat is nearly dry, but yet sticks a little, the parts which are to be bright are rubbed, more or less lightly, with a fine martin or badger brush, which has been filled with dry bronze powder, (a kind of pulverized copper, sold in packages in the paint stores.) The bronze adheres, the paint is allowed to dry, and the article is varnished with good copal varnish.

When articles are to be prepared very carefully, each coat of paint is dried by a furnace or stove heat, and nicely polished when dry. The process given at length above, is the one employed when the object is to work economically; nothing is easier than the preparation of ornaments of this kind.

It is well understood that pulverized copper may be used in bronzing articles to be exposed to the air, when greater brilliancy is required: it is sometimes necessary to give the painting two coats of thick varnish.

[*Jour. des Conn. Usuel. et Prat.*

Extract from the Report of BENJAMIN WRIGHT, Esq., Civil Engineer, who was appointed by the Governor to survey the route of the New York and Erie Rail-road.

TO JOHN A. DIX, Esquire,

Secretary of State:

SIR,—His Excellency, the Governor, having been pleased to appoint me to execute the survey, and make an estimate of the expense, of a rail-road from “*at or near the city of New York, to Lake Erie,*” under the act of May 6th, 1834, which said act requires me to file the report, maps, profiles, and estimates, in the office of the Secretary of State:—

In conformity to said act, I now present my report, maps, profiles,

* A yellow coloured powder, made by mixing together ceruse, alum, and Avignon berry, the fruit of the buck-thorn.—*Trans.*

&c., to be filed in your office, as the law directs, and beg leave hereby

TO REPORT:

That in undertaking the important and responsible duty of surveying the route of a railway communication from the Hudson river, near the city of New York, to Lake Erie, I deem it essential to keep in view the great public objects sought to be attained by the proposed work. It was obvious that the road was to be constructed, not only for the accommodation of the inhabitants of the district immediately adjacent to the route, but also in order to furnish the means of a regular, rapid, and uninterrupted intercourse, at nearly all seasons of the year, between the city of New York, and the extensive and populous communities upon the western lakes and waters.

The vast and acknowledged benefits which had been experienced throughout a great part of the state, and especially by its commercial emporium, from the construction of the Erie Canal, as well in the increase of population and wealth, as in the progress of agriculture and trade, the augmented value of lands, and the rapid and unexampled growth and creation of cities, towns, and villages, along the route, had plainly proved that a thoroughfare running through the southern tier of counties, and properly suited to their topographical character, could not fail to impart similar advantages to that important and valuable section of country, while the pressing necessity of establishing a channel of communication within this state, which should be open during nearly, or quite, the whole of the winter months, and thereby remedy the evils occasioned by its high northern latitude, had not only been felt sensibly by the inhabitants of the metropolis, but had excited public attention throughout a great portion of the fertile and extensive regions upon the upper lakes, and in the valley of the Mississippi.

The long line of counties in our own state, through which the road would pass, favoured as they are with a healthful climate, and an enterprising population, abounding in natural resources, which the proposed work could not fail to develop, also possessed an additional importance in their peculiar topography, being intersected in numerous directions by important streams, leading into that section of the country from other parts of the state, and thereby furnishing striking facilities for connecting the proposed road with lateral branches, capable of accommodating large masses of our population.

Keeping, therefore, steadily in mind, these general considerations, I deemed it an incumbent duty, in selecting the line of location for the proposed road, to obtain a route which, as far as should be practicable, might combine—

1st. Reasonable economy in its construction.

2d. Rapidity and regularity of communication for passengers, light merchandise of value, and the public mail.

3d. Cheapness of transportation for bulky commodities.

4th. Facilities of connection with lateral branches.

5th. The general accommodation of the inhabitants, and the development of the resources, of the country along the route.

And I considered it also necessary to take into view, not only the present, but the prospective, advantages of the route, and to arrange the graduation of the whole work, in reference to such further additions and improvements as might hereafter become necessary, in order to accommodate a great increase of trade and transportation.

Being guided by these general outlines, I commenced the survey of the route on the 23d of May last, under the appointment which I received from his Excellency, the Governor, on the 21st of that month.

It is possible, and I may say probable, that the shortness of time allowed for the completion of so long a line of survey, in some instances not noticed by me, may have prevented our ascertaining the very best and cheapest route, of which some portions of the country may have been capable; but I have become perfectly satisfied, from the lines already run, and minutely measured, that a feasible route has been obtained, free from formidable difficulties, and capable of being completed with economy and despatch.

The great object of securing rapidity and regularity of communication between the city of New York and the lake, being one of paramount importance, I have studiously sought to avoid the use of stationary steam power on inclined planes, as being productive of delay, danger, expense, and difficulty; and in this respect, have been so successful, that, with the exception of one single plane, near Lake Erie, I have brought the whole line within the power of locomotive engines, drawing passenger cars, light merchandize, and the public mail.

The steepest acclivity encountered on the whole line, with the exception before mentioned, will be only one hundred feet per mile; and having been furnished with satisfactory evidence that, by recent improvements in the locomotive steam engines, on the Baltimore and Ohio Rail-road, they have been enabled to ascend an acclivity of 176 feet to the mile, drawing between five and ten tons weight, I rely upon that fact in stating that locomotive steam engines may be advantageously used on the whole of the proposed route, from the Hudson river to the head of the plane near Lake Erie; that they will be able to pass its steepest grades, drawing at least seventy or eighty passengers, with their baggage; while upon at least nine-tenths of the whole route, they will be able to propel very great burthens, at a great rate of speed.

In order, however, to obtain these easy grades of acclivity, I have been compelled to pursue, by a serpentine line, the valleys of streams, and thereby to lengthen very considerably the linear extent of the route.

The general face of the country is undulating, and marked by bold and prominent features; but, nevertheless, it is intersected by numerous rivers and their branches, which have a gentle descent, and fortunately pursue the general direction necessary for the route, in much of the distance.

It is this all-important and cardinal feature in the topography of the country, and the facilities which the valleys of those streams thus present, for obtaining gentle ascents and descents, and moderate graduation, which will explain the reason why I have been able to find a cheap and easy route, without the aid of stationary steam power, through portions of the state which, to the eye of the passing traveller, crossing as he does the numerous hills which are traversed by the ordinary stage roads, would seem to present insuperable obstacles to the accomplishment of the proposed work.

An examination of the plans and profiles returned with this report, will show that the route, instead of passing directly *over*, goes *around* the hills; and that it has not been necessary to surmount any considerable acclivities, except in three or four instances, in which the line crosses the natural boundaries of the great valleys into which the route is topographically divided.

It is true, that the departure from a straight line thus occasioned by following the winding of the water courses, has considerably lengthened the whole route between New York and Lake Erie; but when it is considered that great rapidity of transportation, and cheapness of construction, have been thereby secured, and a greater portion of country accommodated; that the conformation of the country wholly forbade the adoption of any other route, more direct, without enormous expense; and that the circuitry of route will be comparatively less than that of the Pennsylvania Canals, its deviation from a direct line will not be regarded as a formidable obstacle, or objection.

The natural boundaries of the valleys which are pursued by the route, will serve to subdivide it into six grand divisions, to wit:

The *First, or Hudson River Division*, extending $73\frac{1}{2}$ miles from a point in the Hudson river, twenty-four miles north of the City Hall of New York, to a point in the Deer Park Gap, of the Shawangunk Mountain, dividing the waters flowing into the Hudson, from those flowing into the Delaware.

The *Second, or Delaware Division*, extending from the point last mentioned, through the valley of the Delaware and its tributaries, 115 miles, to a summit, twelve miles north-west of the village of Deposit, in Delaware county, dividing the waters of the Delaware from those of the Susquehanna.

The *Third, or Susquehanna Division*, extending from the point last mentioned, through the valley of the Susquehanna and its tributaries, $163\frac{1}{2}$ miles, to a summit, 13 miles south-west of the village of Hornellsville, in the county of Steuben, dividing the waters of the Susquehanna from those of the Genesee.

The *Fourth, or Genesee Division*, extending from the point last mentioned, across the valley of the Genesee, 37 miles, to a summit three miles east of the village of Cuba, in Allegany county.

The *Fifth, or Allegany Division*, extending along the valley of the Allegany and its tributaries, 83 miles, to the head of the inclined plane, distant four or five miles from Lake Erie, on a straight line.

The *Sixth, or Lake Erie Division*, embracing the short and rapid descent to the lake, including the inclined plane and the two branches, one to Portland, nine miles, and one to Dunkirk, eight and a half miles.

It will be perceived by an inspection of the profiles, that the only points where the rates of ascent exceed sixty feet per mile, will be found on the summits above specified, as forming the boundaries of the six grand divisions of the route. The acclivities in passing these summits are respectively as follow:

One grade of one hundred feet to the mile, in passing from the Hudson River Division, down the west side of the Shawangunk mountain, into the Delaware Division:

One of seventy feet, and one of sixty-five feet, to the mile, in passing from the Delaware Division to the Susquehanna Division:

One of seventy feet, and one of sixty-one feet, to the mile, in crossing the ridge between the Susquehanna and its tributary, the Chenango river:

And one of seventy-two feet to the mile, in passing from the Susquehanna Division to the Genesee Division.

I have no doubt that all these ascents and descents above specified may readily be surmounted by locomotive engines drawing passenger cars, light merchandise, and the mail. But in order to aid the passage of burthen cars heavily loaded, it will be necessary to station at the several points above specified, either auxiliary locomotive engines, as is practised on the Liverpool and Manchester Rail-road, or an increase of animal power, as is used in passing the Parr ridge, on the Baltimore and Ohio road. That this can be effected without any material interruption or inconvenience, will be obvious, when it is recollected that the western slope of the Parr ridge, on the last mentioned road, has an ascent of no less than 253 feet to the mile; an acclivity nearly three times as great as the steepest grade on the proposed route; but that it is nevertheless surmounted at all times by burthen cars heavily loaded, aided only by an increase of animal power.

It will also be borne in mind, that at least three-fourths of the heavy tonnage passing on this road will descend eastward, towards tide water. The elevation of the head of the inclined plane near Lake Erie, being 1303 feet above the Hudson river, the products of the western country, passing eastward, will necessarily descend 1303 feet more than they will ascend, and their passage will consequently be aided to that extent by their own gravitation.

It is, however, by no means impossible that, in the course of twenty years, the great increase of the population and agricultural products of the interior, and the necessity of expediting their passage to market, may render it expedient and economical to adopt additional tracks, with a compound moving power, and grades reduced in all cases to thirty feet per mile, with stationary engines, operating on inclined planes, and located at intermediate points along the road. In that event, the entire change might be effected along the whole line, without altering more than thirty or forty miles of the road.

And although I do not believe that this change will ever be made, or become necessary, except in the event of so great an increase of trade as to make steady, uniform power the best, in which case I believe that stationary power, applied on the present grades, would be found the best, and used as Messrs. Walker and Rastrick proposed on the Liverpool and Manchester road, as *reciprocating power*, I have thought it proper to state how far it would affect the graduation of the road to substitute planes and stationary power, and grades in other places of thirty feet per mile.

The change of plan last mentioned would only apply to burthen cars, in any event, as passenger cars would be liable to less danger, interruption, and delay, by using the locomotives, or extra animal power, to surmount the dividing ridges.

In making the survey and location, I have had lines of exploration made on various parts of the route, in two or three different directions, and more particularly near the Hudson river, where four different routes to several landings were examined, and are all represented on the maps and profiles herewith returned; and if the funds had held out to accomplish some further examinations in Rockland county, and time had permitted, I should have pursued still another line from a point on map No. 1, marked Z, and followed on the northern and eastwardly side of the Hackensack river, in the direction of the dotted line, so as to join the line which runs to the river at Tappan. Such a line ought to be explored before the final location of the road through Rockland county.

Another part of the line in Orange county ought also to be noticed, as deserving of further examination, which is exhibited in maps Nos. 3 and 4. A strong and ardent desire to accommodate, by passing in the immediate vicinity of so important a town as Goshen, and former examinations for a rail-road having produced impressions favourable to that route, I had supposed it would prove the best ground, and therefore spent our labours upon it; and it was not until it was too late, that we observed the formation of the country from near Chester, through by Florida, and the practicability of passing the Wall Kill near Pellet's Island, and joining the present line some six or seven miles west of Wall Kill, that we supposed we could change from the route near Goshen. This route requires an instrumental examination; but unless it prove greatly superior to that by Goshen, as now returned, the accommodation of so important a town ought to give it the preference. The routes between the Wall Kill and Shawangunk mountain are exhibited on the map and profiles, and a final location on this part is intimately connected with the suggestion about the Florida route.

It has been proposed to cut upon the top of the Deer Park Gap, (which is a deep depression of the Shawangunk mountain,) about fifty feet at the highest point. This is done in order to reduce the grade upon each side, and particularly on the west side, to one hundred feet per mile. The east side can be easily reduced to a grade of sixty feet, for a short distance, and then much less.

I have looked at this point, and given it considerable thought, to

determine what ought to be the present plan, in reference to future improvements, when the great increase of business on this road will demand every facility that the nature of the country will permit; and it has brought my mind to the conclusion, that before the lapse of twenty years after the completion of the road, a tunnel will be driven through the mountain, of about three-quarters of a mile in length, whereby its elevation would be so reduced, as to permit a grade of probably seventy-five to eighty feet, on the west side, and about thirty on the east. As the acclivity of one hundred feet to the mile, on the west side of the mountain, is the steepest grade encountered on the road, it has also appeared to me to be well worthy of observation, how far this ascent could be relieved by the adoption of an inclined plane with a stationary engine, believing that, if it is admissible on any intermediate point on the route, it might be employed at this point, for the relief of the burthen cars, to great advantage. The idea of the tunnel, and the stationary engine, will, however, be matters of subsequent inquiry, at some future time, and are now referred to, only as parts of an ultimate plan, proper to be borne in mind, in the permanent location of the route.

The line, as located, then follows from the foot of Shawangunk mountain, by a high embankment across the valley of Basher's hill, and then crosses the Delaware and Hudson canal without difficulty, and soon enters the valley of the Neversink river, which it follows to the mouth of a branch of this river, called the Sheldrake, and up that to its source; thence crossing the heads of the several branches of the Mongaup, it reaches the head of the Callicoon, (a branch of the Delaware,) which it follows to its junction with the latter river.

An examination of the ground plans will show that a route has also been surveyed down the Popackton, or eastern branch of the Delaware; and there are also exhibited and marked, several other routes through Sullivan county, which have been examined, and regular surveys carried over them, and profiles made of some.

The route passing near Monticello, which is the county town of Sullivan county, would on that account deserve a preference, if the facilities and advantages are nearly equal as to other points, such as grade and cheapness of construction; and although our surveys, as we made them, did not show as favourable a line by Monticello as by the other route, I think a further and more critical examination should be made through this district of country, to find a more favourable route than we have yet seen; and should this be the case, we should, I think, shorten the route some miles, and obtain the advantages of carrying it through a more populous and settled country.

[TO BE CONTINUED.]

¶ *Sulphuric Acid as a Prophylactic against Lead Colic.*

Some time ago, M. Gendren proposed sulphuric acid lemonade as a prophylactic against, as well as remedy for, lead colic, (see this

journal for May, 1832, p. 241.) M. G. has recently communicated to the Academy of Sciences, some additional interesting information on this subject. He states that M. Rouard, director of a manufactory of white lead, caused all his workmen to take the sulphuric acid lemonade, and from that moment lead colic ceased to occur among the men in the establishment. During two months, only four workmen were slightly affected with lead colic, and this exception is explained by circumstances peculiar to these workmen. But, he adds, that at the same time that these results have confirmed the utility of the measure, as regards colic, six of the workmen were attacked with symptoms hitherto regarded as the effects of lead colic, as cramps, muscular debility, and nervous epileptic symptoms. These symptoms, M. Gendren ascribes to a layer of oxide and carbonate of lead, combined with the epidermis. This observation he considers as accounting for many symptoms hitherto difficult of explanation, and points out the origin of the relapses and symptoms which so often supervene after the cure of colics in workmen habitually exposed to the powerful action of the causes of the disease. He further adds, that whether the sulphuric acid be used as a prophylactic or remedy, it must be employed externally, as well as internally. Conformably to this indication, the workmen in the establishment of M. Rouard, at the same time that they take the sulphuric acid lemonade as drink, use lotions of the same to the surface of their bodies.—*American Journal of the Medical Sciences*, Feb. 7, 1835.

On a Steam Engine for Pumping Water. By W. L. WHARTON.

In this engine, the steam is admitted from the boiler upon a deep float, occupying the top of a column of water contained in a metallic cylinder, placed in the flue of the boiler fire. The lower part of the column of water is connected by pipes to the under side of a piston, moving water tight in a much smaller cylinder, fixed immediately above the pumps of any mine, to the rods of which is affixed the piston rod. By this arrangement, the steam always acts upon a heated surface, and its power is applied to the pump rods without the intervention of a main beam, parallel motion, &c., and, consequently, without any expense for frame-work, and buildings requisite for their support, in other engines. The friction of this engine, moreover, is very trifling, a stratum of oil being introduced both above and below the piston. A rod, or wire, is attached to the float, and passing through a stuffing box in the top of the large cylinder, works the hand gear at the proper periods after the admission and escape of the steam, and consequent depression and elevation of the water and float, within that cylinder. A condensing apparatus may be added, by which the atmosphere may be rendered available, in addition to the weight of the pump rods, to force down the piston in the small cylinder, and, consequently, the water and float, to the top of the large cylinder, after each stroke of the engine.

[*Rep. Brit. Assoc.*

¶ *The Mariners' Compass.*

The mariners' compass is generally stated to have been invented by one Flavio Gioia, a native of Amalfi, in 1302, or 1303; but, from a letter on the subject, addressed to Baron H. A. Humboldt, by Mr. J. Klaproth, reviewed in the *Athenæum* of Saturday last, (No. 369,) it appears very clearly that the magnet's polarity was popularly known in Europe at least a century earlier, and in China as far back as authentic history reaches. "A remarkable proof," says the reviewer, "of the Chinese claims to this invention, is to be found in the history of the *magnetic chariots*, whose origin is lost in the obscurity of the mythological ages." * * A (human) "figure, in front of the chariot, was made of some light material; it was fixed upon a pivot, and its finger invariably pointed to the south, which was the *kibleh*, or sacred point, of the Chinese, to which they always turned when performing their devotions. It is intimated, rather obscurely, that these magnetic chariots were first invented for a religious purpose, namely, to enable the devout to discover their *kibleh*, when the sun and stars were obscured by clouds—a purpose for which the compass is frequently applied in the present day by Mohammedan nations; but there are very full descriptions of the use made of these chariots in directing the march of armies, and guiding ambassadors. * * As our readers have probably anticipated, a magnetised bar passes through the arm of the figure, and the only variety of ingenuity displayed by the architects, was in balancing the figure upon its pivot. The antiquity of these magnetic chariots is established incontrovertibly; the step from them to the compass is so very easy, that we may safely assert that the one must have led immediately to the other."

[*Lond. Mech. Mag.*

List of American Patents which issued in March, 1835.

	<i>March</i>
96. <i>Oil bush, &c.</i> —Jesse Kinman, Clinton, Penn.	2
97. <i>Flour packing machine.</i> —John Kinman, Hartley, Penn.	2
98. <i>Plough.</i> —Joseph Tinkler, Warwick, Penn.	2
99. <i>Stones, raising.</i> —John C. Blauvelt, Newton, Conn.	2
100. <i>Propelling machine.</i> —Luke M. Edwards, Trenton, Tenn.	2
101. <i>Wheeled carriages.</i> —Samuel Chapman, jr., Windsor, Mass.	2
102. <i>Casting chilled rollers.</i> —James Harley, Pittsburg, Penn.	3
103. <i>Cook stove.</i> —Joel Rathbone, Albany, New York,	6
104. <i>Horse hame collar.</i> —Timothy Deming, East Hartford, Conn.	6
105. <i>Trip hammer.</i> —Heman Redfield, Grafton, Mass.	6
106. <i>Winnowing machine.</i> —Truman B. Browne, Locke, N. Y.	6
107. <i>Seaming tin plate.</i> —James Redheffer, Bridgetown, New Jersey,	6
108. <i>Catching fish.</i> —Charles Fowler, and E. R. Hanks, Hartford, Conn.	6
109. <i>Brushes for colours.</i> —George M. Morris, city of Philadelphia,	6
110. <i>Saw, using.</i> —Anson Field, Jerico, Vermont,	6
111. <i>Thrashing machine.</i> —Thomas D. Burrall, Geneva, New York,	6
112. <i>Mariners' Compass.</i> —Jonathan Ball, Buffalo, New York,	6
113. <i>Fishing Boat.</i> —John Donn, Washington, D. C.	6

March

114. <i>Stove</i> .—George J. Payne, Erie, New York,	6
115. <i>Sausage cutting machine</i> .—P. Fahnestock, and J. Mann, jr., Quincy, Penn.	11
116. <i>Printing press, improved</i> .—John C. Rives, Washington, D. C.	11
117. <i>Grates</i> .—Barnabus Pike, city of New York,	11
118. <i>Tailors' shears</i> .—J. Andrews, assignee of R. Heinisch, city of New York,	11
119. <i>Water wheel</i> .—Robert Eastman, Concord, New Hampshire,	11
120. <i>Water closet</i> .—James Stone, city of New York,	11
121. <i>Horse hanes</i> .—Timothy Taylor, Loudon county, Virginia,	11
122. <i>Mortar machine, &c.</i> —Samuel Whitman, Danville, Ill.	11
123. <i>Churn</i> .—Benjamin Randall, N. Pownal, Maine,	11
124. <i>Horse power</i> .—William E. Arnold, Chatham, Conn.	13
125. <i>Steam wheel</i> .—William Wilson, Henderson county, Tenn.	13
126. <i>Hulling, shelling, and thrashing, machine</i> .—Jesse S. Dick, Genessee county, New York,	13
127. <i>Boats for rivers and canals</i> .—Anthony Plantou, Philadelphia,	18
128. <i>Carriage springs, connecting</i> .—Amos Davis, Easton, Maryland,	18
129. <i>Grain mill</i> .—Frederick Smith, Evans, New York,	18
130. <i>Garlic and smut machine</i> .—T. J. Sands, and B. Hendig, Washington, Penn.	18
131. <i>Composition for white paint</i> .—Forrest Shepherd, Fredericksburg, Va.	18
132. <i>Coach panels of metal</i> .—Ebenezer A. Lester, Boston, Mass.	18
133. <i>Ointment</i> .—William W. Gears, Richmond, Va.	18
134. <i>Wrought nail machine</i> .—Samuel G. Reynolds, Providence, R. Island,	18
135. <i>Mills, metallic, dressing</i> .—Samuel G. Reynolds, Providence, R. I.	20
136. <i>Thrashing machine</i> .—David G. M'Coy, Dublin, Maryland,	20
137. <i>Cotton and hay press</i> .—Samuel T. Baker, W. Gorham, Maine,	20
138. <i>Power loom</i> .—David Whitman, Windham, Conn.	20
139. <i>Rail-road car wheels</i> .—John Baker, Lancaster, Penn.	20
140. <i>Franklin cook stove</i> .—Isaac M'Nary, Stafford, Conn.	24
141. <i>Washing machine</i> .—Stephen A. M'George, Alexander, New York,	24
142. <i>Steam engine</i> .—John Murphy, Philadelphia, Penn.	24
143. <i>Steam engine</i> .—John Sheldon, New Haven, Conn.	24
144. <i>Grinding and polishing stone</i> .—Peter Cooper, city of New York,	24
145. <i>Steam power and boiler</i> .—Benj. B. Gates, Ontwa, Michigan,	24
146. <i>Plough</i> .—Nathaniel Baker, Penn township, Michigan,	24
147. <i>Furnace stove</i> .—Henry Hubbard, Berlin, Connecticut,	25
148. <i>Rail-road car</i> .—John Withers, Bart township, Penn.	25
149. <i>Rail-road car</i> .—James Herron, Richmond, Virginia,	25
150. <i>Tobacco, chewing, manufacturing</i> .—Edward Chassaing, city of Baltimore,	25
151. <i>Blinds for doors and windows</i> .—Seril Steere, Gloucester, R. I.	25
152. <i>Pendulum power machine</i> .—Abraham Wade, Eagletown, New York,	25
153. <i>Leather finisher</i> .—Cushman Bassett, Boston, Mass.	25
154. <i>Saw mill dog</i> .—Martin Rich, Caroline, New York,	25
155. <i>Plough</i> .—William Hess, Lower Saucon, Penn.	27
156. <i>Hair, extracting</i> .—Samuel G. Ladd, assignee of S. Graham, Farmington, Maine,	27
157. <i>Saw mill</i> .—N. and P. Crosby, Pomfret, New York,	27
158. <i>Washing machine</i> .—E. Whitman, jr., assignee of E. Whitman, Winthrop, Maine,	27
159. <i>Churns and cradles, propelling</i> .—Ezra Winthrop, jr., Winthrop, Me.	27
160. <i>Inking machine</i> .—S. Fairlamb, and J. L. Gilpin, city of New York,	27
161. <i>Sad iron</i> .—William Wilson, Greenfield, Mass.	27
162. <i>Saw mill dog</i> .—Martin Rich, Caroline, New York,	27

CELESTIAL PHENOMENA, FOR JUNE, 1835.
Calculated by S. C. Walker.

Day.	H'r.	Min.				
2	8	32	N. App. γ and η Leonis, $\gamma, 4, \gamma$	South $1^{\circ} 6'$		
6	7	23	Im. β Virginis,	$\gamma, 6,$	N. 12°	V. 3°
6	8	20	Em.		274°	274°
7	5	19	$\gamma \delta$ ϵ Geminorum, γ, γ	North $18''$		
11	16	20	Im. σ Sagittarii,	$\gamma, 3,$	156°	189°
11	16	57	Em.		230°	267°

Meteorological Observations for February, 1835.

Moon.	Days.	Therm.		Barometer.		Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sun rise.	9 P.M.	Sun rise.	9 P.M.	Direction.	Force.		
				Inches	Inches			Inches.	
	1	27 ^o	31 ^o	29.46	29.50	W.	Moderate.		Flying clouds.
	2	29	23	29.75	29.90	W.	do.		Clear day.
	3	16	25	30.10	30.15	NW. NE.	do.		Cloudy—lightly cloudy.
	4	12	17	29.96	29.95	NE. NW.	do.		Clear—lightly cloudy.
	5	12	13	29.95	29.95	NW.	Brisk.		Cloudy—flying clouds.
	6	21	31	28.84	28.80	SE. S.	Moderate.		Cloudy—snow.
	7	12	13	27.75	27.85	W.	Bustering		Clear day.
	8	3	7	30.30	30.20	W.	do.		Lightly cloudy.
	9	1	15	30.10	30.10	W.	Moderate.		Clear day.
	10	4	18	29.90	29.75	W.	do.		Clear day.
	11	10	30	29.50	29.75	SW.	do.		Lightly cloudy—cloudy.
	12	18	26	28.60	28.66	NW.	do.		Clear day.
	13	22	41	27.75	27.80	SW.	Bustering		Lightly cloudy.
	14	34	32	29.34	30.15	W. NW.	do.		Cloudy day.
	15	18	22	29.90	29.80	NE.	do.		Cloudy day.
	16	20	30	30.10	30.15	SE. NE.	do.		Sleet—rain.
	17	30	31	29.94	29.85	NE.	Calm		Clear—rain.
	18	33	41	28.66	27.70	W.	do.		Rainy day.
	19	34	39	28.33	28.30	W.	do.		Cloudy—flying clouds.
	20	29	44	30.20	30.35	W.	do.		Lightly cloudy—flying clouds.
	21	27	44	29.20	29.05	SW.	do.		Clear—flying clouds.
	22	40	51	29.85	29.80	SW.	do.		Cloudy day.
	23	37	34	30.06	30.16	SW.	do.		Cloudy—snow.
	24	29	40	29.29	29.25	NE.	do.		Cloudy—lightly cloudy.
	25	31	40	29.10	29.06	E.	do.		Cloudy day.
	26	30	30	29.05	30.00	W.	do.		Cloudy—lightly cloudy.
	27	16	22	29.39	29.80	NW.	do.		Snow—cloudy.
	28	5	30	28.86	29.00	NNE. W.	do.		Clear—lightly cloudy.
	Mean	21.21	29.36	29.32	29.94			9.04	

Thermometer.

Maximum height during the month, 54. on 22d.

Minimum do. — 3. on 8th.

Mean do. 25.28

Barometer.

30.35 on 20th.

29.46 on 1st.

29.93

JOURNAL
OF THE
FRANKLIN INSTITUTE

OF THE
State of Pennsylvania,

DEVOTED TO THE
MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,
AND THE RECORDING OF
AMERICAN AND OTHER PATENTED INVENTIONS.

JUNE, 1835.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—In the January number of the Journal, a communication signed T. W. B. presents a supposed error from Arnott's Physics, in the following words,—“When any elastic body, as a billiard ball, strikes any other body larger than itself, and rebounds, it gives to that other body, not only all the motion which it originally possessed—this being done at the moment when it comes to rest—but an additional quantity, equal to that with which it recoils.”

This he considers erroneous, and contends “that when any elastic body strikes any other, larger than itself, and rebounds, it does not give to that other all its motion, by just so much as it does rebound.”

It will be admitted by your correspondent, that, if an elastic body strikes an *equal* body at rest, it communicates all its motion to the other, and remains at rest after the stroke; and that in this instance, at least, the striking body has communicated all its motion “at the moment when it comes to rest.” Let the same elastic body strike against a smaller one, and I contend that it will not impart all its motion, by just so much as it *retains*; that is, it will continue moving forward, though with less velocity, after the stroke.”

Now, it is clear that this result is not the same as that in which the body struck was larger than the striking body; and it is equally evident that, when the stricken body rebounds, it imparts more motion than when it merely comes to rest, (or more than all it possessed, by just so much as it recoils,) and more when it remains at rest than when it continues moving forward, after the impact.

This is unquestionably true, as regards the *motion* of bodies; but
VOL. XV.—No. 6.—JUNE, 1835.

let it be observed, that the *motions* and *forces* of bodies are distinct things, and must be estimated by different standards of measure; in other words, the "momentum," (quantity of motion,) and the "power,"* are the products of different elements: the former, of the *quantity of matter*, multiplied into its *velocity*—and the latter, of the *degree of force*, into the *distance* through which it is exerted.

Two bodies may possess equal *momenta* and equal *power*, or they may have equal *momenta* and *unequal* power. An example of the first case is presented when two equal bodies, having equal velocities, meet; for they arrest each other's motion, and they exert equal degrees of force on each other, through equal distances.

The second case is shown when two unequal bodies, whose relative velocities are inversely as their quantities of matter, impinge upon each other; for, as in the former case, they arrest each other's motion, but do not exert their mutual forces, (which are equal,) through *equal distances*, but through spaces proportionate to their respective velocities.

Now I maintain that, in every case of impact, there must, of necessity, be more or less yielding of the impinging bodies, after they first come into contact; and, consequently, that they continue for a time to move towards each other, although their action may appear to be instantaneous. This being admitted, and their mutual forces being of equal intensity, it follows that the body which *passes over the greatest proportion of distance* during the conflict, performs, in the same proportion, the greater share of the *labour* of the operation.

For example, the body A, whose mass is 1, with a velocity of 2, meets the body B, whose mass is 2, with a velocity of 1; the bodies being soft, remain at rest after the stroke, proving that A had just as much motion as B; but as they retain their relative velocities to the last moment of their motion, A necessarily travels twice as far as B, or two-thirds of the distance passed over between them; showing that the quantity of force of A was twice as great as that of B.

The motion of a body and its force differ essentially in this, that the latter has no existence, (as a force,) only during a change in the former; that is to say, a body in a state of rest does not possess this force in any particular direction, as then it would require to be retained by the aid of force; nor does it, as some learned authors assert, constantly exert this force in every direction, since such a distribution of force, would leave the body without any power to resist an impulse, just as if no such force existed.

Again: a body in a state of uniform motion, is as perfectly passive as when at rest; for the effect of force in any direction, would be instantly to produce a change, and if in all directions, to neutralize itself.

I have avoided, in this discussion, the use of the term "*vis-inertia*," to distinguish that force of matter by which it resists a change of motion, for the reason that *force of passiveness* is a contradiction of

* By the power or quantity of force possessed by a moving body, I would be understood, so much as is due to its velocity, or what it will exert in coming to a state of rest, and not as having any reference to the absolute force; that being unlimited, either in degree or quantity.

terms, conveying to some minds the idea of force, and to others its opposite, and thus embarrassing the student in a subject in itself sufficiently obscure and intricate; although I confess myself unable to find a term exactly suited to express the distinguishing quality of that force, inasmuch as it is either active, or passive, according to circumstances. Hence the name "*vis-inertia*," which, if the "*vis*" were always retained, is perhaps more expressive of its true character than any other term.

If, however, as is very often the case, the "*inertia*" is to be taken as expressive of the thing itself, instead of its peculiar *quality*, a more unsuitable term could not be found, since it conveys the idea of the *absence* of the force in question.

Now, as this force is a *something*, which is sometimes *nothing*, and cannot be clearly designated by *anything*, suppose, for the sake of avoiding the perplexing tendency of the term "*inertia*," we amend the word, by substituting for *r*, the letter *p*, and call it what it is, in fact, *ineptia*, *vis-ineptia*, or *queer* force.

Some excellent mechanics understand "*inertia*" to mean a property of matter, by which it endeavours to maintain a state of rest—and *momentum* to be of an opposite character; some contending that *momentum* is of the nature of *force*, and "*inertia*" of *passiveness*; while others of high respectability reject the idea of force, of "*inertia*," and *momentum*, altogether.

Dr. Young supposes that the "*inertia*" of matter "cannot be a force," because, if it were, it must be of some definite quantity in a given body." Let us apply this rule to the other forces of matter, gravitation and repulsion; are either of these acknowledged forces of any definite quantity (degree) in a given body? Certainly not; for, like *ineptia*, both are *conditional*, depending on the reciprocal action of something else, and thereby subject to variation in any degree; the one depending for its *existence*, upon an opposite force, and upon the degree of that force, for its *intensity*, or degree; the others depending for their *existence*, in matter, upon the *existence* of other matter, and for their degree upon its *proximity*.

To those who allow to matter the power of occasionally exercising *force*, and still, like your worthy correspondent, confound the laws of *force* and *motion*, I would urge the propriety of considering force in its most general sense—as being always the same thing, (under whatever circumstances,) subject to the same general law, of acting always equal and opposite to *force*, and characterised by its power of changing the motions of bodies, and of producing other mechanical effects. Let it be taken, in its connection with matter, as entirely unaffected by the mere circumstance of motion, which, after all, is only a change of place, and often only apparently so.

No condition of the motion of a body can at all affect its power to resist a force impressed upon it, either in kind or degree, its resistance being always equal to the force impressed, whether employed in retarding or accelerating, arresting or generating, motion.

For example, a cannon ball, shot directly upward, would, if unresisted, preserve a uniform velocity in the same direction, unaccompa-

nied by *force* of any sort, (in other words, retaining its *power* to exert a *force* when called for,) forever. But if, at any time, the force of gravitation should begin to act, the ball would then exert its *ineptia* upward, *equal* and *opposite* to gravity, and thus it would continue *through all the change of the ball's velocity and direction*, until its final return to the earth; affording, by the way, the true rationale of retarded and accelerated motion, by a constant force.

Having established a proper distinction between *motion* and *power*, it is easy to explain to so intelligent a reasoner as T. W. B., wherein he has mistaken the matter. Had he asserted that, "when any elastic body strikes another body larger than itself, and rebounds, it does not give to that other body all its *power*, by just the quantity with which it rebounds," he would have stated the fact; for whilst the *momentum* of a given body is in the simple ratio of its velocity, the *power* is in the ratio of the *square* of the velocity, and the sum of power possessed by the bodies after the stroke, will be the same (whether the body struck be larger or smaller) as that originally possessed by the striking body; that is to say, when the body struck is *smaller*, and does not receive all the motion of the other, the sum of the products, of their quantities of matter, multiplied into the *squares* of their velocities respectively, after the stroke, will be the same as when it is *larger*, and causes the striking body to recoil, or when they are *equal*, and the striking body remains at rest after the impact.

It is a well known law of falling bodies, that their distances passed over are in the ratio of the *squares* of their velocities; and experiment proves that, if a body is let fall upon an elastic table, it will rebound to the height from whence it fell; showing that the power employed in giving the body velocity, and that employed in taking it away, is proportionate to the square of that velocity.

It was not my intention to have gone so far into the subject; but *receiving the impulse from a powerful body, and meeting but little resistance from gravity*, and following implicitly the *laws of motion*, I have passed over a reasonable quantity of matter, (taking the *distance*, instead of the *velocity*, as the *standard of measure*,) by the mere *vis-ineptia*.

Respectfully,

RUFUS TYLER.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

On the Evidence of Certain Phenomena. By W. C. REDFIELD.

The "Notes of an Observer,"* containing some strictures on two papers relating to meteorology, which are found in the twenty-third volume of the American Journal of Science, are doubtless entitled to notice from the writer of this article, which would have been more promptly given, had those strictures met his eye at the time of their publication; but he had, unfortunately, no knowledge of their ap-

* Journal of the Franklin Institute, vol. xiii., p. 9.

pearance, till a few days since, when chance brought them under his observation.

The intelligent writer of the notes introduces his strictures on the two papers alluded to, by the following remarks:

"They contain a most laborious collection of facts, which, if well authenticated, will be of immense importance to meteorological science. Some of them, however, are so anomalous, and inconsistent with received theories, that I hesitate to put entire confidence in them, and shall continue to doubt until I have the most certain evidence of the facts."

As was partially intimated in those papers, circumstances do not permit me to set forth in detail the great mass of evidence and authorities by which the statements in those papers are sustained, or even to such an extent as I deem to be highly desirable. It does not, however, seem necessary that facts in this department of science should be rejected, or even doubted, for no better reason than being "inconsistent with received theories;" for while, in the present improved state of physical science, we are so justly rigid in demanding correct inductions from well observed or established facts, before we consent to give credence to *new* theories, it may be well, perhaps, to inquire when, and in what manner, the "received theories" in meteorology have been demonstrated to be true. That the theories in question have long been received, and that they influence and control our modes of thinking and reasoning on these subjects, is doubtless true; and it is believed that the latter often happens, too, in the face of much positive evidence of their fallacy. Nor is such a mental process at all uncommon, even in this age of the exact sciences, and I have had occasion to see the most unsupported and conjectural hypotheses adduced by able writers, as satisfactory disproof of a series of well observed facts. But to return to the "Notes of an Observer," who proceeds to particularize his exceptions as follows.

"For example: In p. 132 he says, 'In large portions of the Pacific Ocean, the tides are exempt from the lunar influence. At Tahiti and the Georgian groupe, near the centre of the Pacific Ocean, the tide rises but one or two feet, and it is high water at noon and midnight throughout the year, and this, too, in the very region where the established theory would lead us to expect the lunar tides to be the most regular and powerful.' Again, in p. 128, he says: 'In Peru, at the height of 18,000 feet, the wind has been found to be fresh from the south-west,' meaning, if I understand the whole paragraph, that this is the prevailing direction of the wind at that place."

Without inquiring whether the closing inference here quoted be justly warranted by the paragraph to which he alludes, I have to remark that it is *possible* that my statement in regard to the tides at the Society Islands, and certain other parts of the Pacific, may prove not to have been sufficiently guarded. We should naturally think that, even in the absence of such lunar influence, the momentum of the tides from other portions of that great ocean would necessarily affect the equilibrium of the surface at these islands; and Prof. Whewell,

in his able elucidation of the cotidal lines, has given the time of high water at these islands, without any direct intimation of such phenomena. But, on the other hand, we have the authority of gentlemen who have been attached for many years to the English missions at these islands, and who, from their known habits of life, must be supposed to be thoroughly conversant with the facts of the case, in support of the statement which I have made. The following statement of the Rev. William Ellis, one of the gentlemen alluded to, and who has returned to England, may be found in his *Polynesian Researches*, at p. 28-9, vol. i. of the second London edition.

“Among the natural phenomena of the South Sea Islands, the tide is one of the most singular, and presents as great an exception to the theory of Sir Isaac Newton, as is to be met with in any part of the world. The rising and falling of the waters of the ocean appear, if influenced at all, to be so in a very small degree only, by the moon. The height to which the water rises, varies but a few inches during the whole year, and at no time is it elevated more than a foot, or a foot and a half. The sea, however, often rises to an unusual height, but this appears to be the effect of a strong wind blowing some time from one quarter, or the heavy swells of the sea, which flow from different directions, and prevail equally during the time of high and low water. But the most remarkable circumstance is the uniformity of the time of high and low water. During the year, whatever be the age or situation of the moon, the water is lowest at six in the morning, and the same hour in the evening, and highest at noon and midnight. This is so well established, that the time of night is marked by the ebbing and flowing of the tide, *and in all the islands the term for high water and midnight is the same.*”

A fact which is thus substantiated, and which has become incorporated into the very language of a whole people, it would be difficult to call in question. It is supported also by the testimony of Messrs. Tyerman and Bennett, in their *Journal of Voyages and Travels*,* to say nothing of facts collected from other sources, or which have the same bearing, though relating to other regions. I will mention, however, that Mr. Whewell quotes the observation of Capt. Beechy, that at Papiate, one of the Society Islands, it is high water *every day* at half an hour before noon, and low water at six in the evening; and he also informs us that Lieut. Malden (Lord Byron's voyage) gives a similar account of the tides at Owhyhee, situated in a corresponding latitude and position in the *northern* Pacific. In the last number of the *American Journal of Science*,* we have also a further confirmation of the fact in question, as given us by Mr. John Ball, of Troy, New York, at the close of his interesting account of the country west of the Rocky Mountains; he says, “A return from the Columbia river by water around Cape Horn, touching at the Sandwich and Society Islands, gave some opportunity to observe the winds, and other phenomena.” “During three weeks stay at Tahiti, the tide was observed to rise about one foot, and always highest at twelve o'clock, noon and midnight, and I was informed that this is always the case.”

* See Boston edition, vol. ii., p. 225.

† Vol. xxviii. p. 8.

It must, therefore, I think, be admitted, that there is a suspension or neutralization of the lunar tide-wave in the region in which those islands are situated. We find, too, that in the Atlantic it is high water on the coast of Surinam about five o'clock on the days of the new and full of the moon, and the flood runs to the westward. At the windward islands of the West Indies, the tide is some one or two hours later, and, though exposed to the whole tide range of the Atlantic, the tides are very weak and irregular, not rising more than at the Society Islands. On the southern coast of the United States, and at the island of Bermuda, in the Atlantic, it is high water about seven o'clock, the flood tide in the offing at the latter place *running to the northeast*. On the southern coast of Rhode Island and Massachusetts, it is high water from seven to eight o'clock. On the southeastern coast of Nova Scotia and Newfoundland, it is high water from eight to nine o'clock, the flood tide off the latter coast also running northeastwardly. At the Azores, or Western Islands, in lat. 38° N., near the middle of the Atlantic, it is high water about 12 o'clock, *and the flood runs to the eastward*.† Finally, it is high water on the western coasts of Ireland and Spain about two o'clock, all on the same days. These statements are approximated from the American Coast Pilot, and other authorities, care being taken to avoid the retarding effects of local obstructions as far as possible, by timeing from the most extraneous positions of coast, towards the open ocean. Viewing these phenomena in connexion with some other facts, had led me to suspect that the great tide wave performed an actual circuit in each of the great oceanic basins, on both sides of the equator, passing *westwardly* in the equatorial latitudes, and returning *eastwardly* in the higher latitudes, above 25° or 50° north and south, and analogous to the course which is pursued, as can be demonstrably shown, by the great *currents*, both of ocean and atmosphere. If such be the operation of the tides, certain regions in mid-ocean would form the foci, or neutral points, in these great elliptical circuits, and would be but slightly, if at all, affected by the ordinary tides. The elaborate investigation of cotidal lines in which Professor Whewell is engaged, will probably show whether this conjecture is well founded, or whether the course of the great tide wave be from the Southern Ocean, northwardly, through the entire length of the Atlantic, and in disregard of the direct lunar influence in this ocean, as would seem to be indicated in his late paper on that subject. The greatest difficulty attending the inquiry, is in procuring correct observations from those islands and external points of coast, which bear most decidedly upon the question; and whatever may be its results, I am happy to find that a course or method of investigation which has governed my own inquiries in meteorology, has been adopted on this kindred subject, by so able a hand.

The second statement objected to by the writer of the notes, that "in Peru, at the height of 18,000 feet, the wind has been found to be fresh from the south-west," was given on the authority of Samuel Curron, Esq., whose interesting narrative of his ascent to the Peak

† See Penny Cyclopaedia; article, Azores.

of Misté may be found in the Boston Journal of Philosophy and the Arts, vol. i., see p. 364-5. The authorities for the Sandwich Islands and Peak of Teneriffe, which were included in my statement, are also at hand; and I may add that the Rev. John C. Brigham, the present Secretary of the American Bible Society, in crossing the Andes, from Buenos Ayres to Chili, at the height of 17,000 feet, found the wind blowing strong from the west, as he has himself informed me.*

There are other facts which seem to indicate the prevalence of a southwesterly wind over the higher regions of tropical America, such as the fall of ashes, in 1812, at Barbadoes and elsewhere, from the volcano of St. Vincent; and the late fall of volcanic ashes at Jamaica, and other places, in January of the present year, which appears to be traced to the tremendous outbreakings of volcanos on the continent, near the Bay of Honduras.

It is unfortunate that those who visit high mountains, so generally neglect to inform us of the direction of the wind in those regions. I have been led to suspect, however, that in some, at least, of the cases mentioned by me, those winds were occasioned by the diurnal influences of heat and cold upon the stratum of air *lying upon the inclined surface of the mountain*. This was first suggested by the statement of Mr. Brigham, who was informed by the natives that this wind blew only in the day-time, and it seems not unlikely that most elevated peaks are subject to a similar influence. We have, however, far better evidence afforded to us of the course of the higher strata, in the movements of the clouds at different altitudes, which should have been recorded more generally than has yet been done. The fact appears, however, to be well established, that the great trade wind of the tropical latitudes does not prevail at any great altitude, nor does it usually cross any elevated region of country, to say nothing of its being arrested or deflected by its own gravitation in mid-ocean, in the Indian seas, and on the bosom of the great Pacific. But to return to the only remaining position which is called in question by the author of the notes, and which is in the following words.

“The regular semidiurnal variations of the barometer is at its maximum about 10, A. M., and at its minimum about 3, P. M.; at New York it is nearly the same; *but at Edinburgh, the effect is reversed, the minimum being at 10, and the maximum at 3 o'clock,*’ &c. I was (says the writer of the notes) startled at this statement, and immediately began to look for authorities to confirm or refute it, when I happened on the following passage in the second report of the British Association for the Advancement of Science, p. 131.”

This is followed by a condensed statement of the observations made near Edinburgh, by Professor Forbes, since 1827, which have been published at length in the Edinburgh transactions; from which it appears that near Edinburgh, in latitude 56°, the mean annual oscillation between 10, A. M. and 4, P. M., is .0106 inches; and

* See Missionary Herald for 1826, vol. xxii., p. 153-4, where the *direction* of the wind is not mentioned.

that the St. Bernard observations, 8000 feet above the level of the sea, and those of Capt. Parry, in the Arctic regions, both indicate a true negative oscillation, &c.

I readily acknowledge a partial inaccuracy in my statement, which should have read, "but in high latitudes the effect is reversed," &c., the locality or latitude of Edinburgh not being that in which the negative oscillation is established; and the error was subsequently so corrected. It may, however, be proper on this occasion to explain the cause of the inaccuracy. A short time before I was called upon to sketch the facts in meteorology, to which the foregoing exceptions had been made, the paper of Professor Forbes, above referred to, had met my eye, under circumstances, however, which precluded its perusal; and on glancing over its pages, and the illustrations which accompanied it, I perceived that the Professor had shown a negative oscillation of the barometer, taking effect somewhere in the higher latitudes, and his extensive series of observations having been made near Edinburgh, I was led to infer that this conclusion, or result, had been directly deduced from these observations. Under this impression, I ventured to pen the statement in its original form, which I should not have done, however, unless I had at that time felt myself certain of an opportunity to give the paper of Professor Forbes a thorough perusal, before my statement should pass through the press; but the concurrence of an unlooked-for accident, with a more speedy publication than I had anticipated, prevented my design from being realized.

I have now given the authorities and explanations to which the author of the notes seems entitled, and it may not be improper to state, for the satisfaction of those who may have read my articles on the storms of the American coast,* that the method pursued by me in investigating the physical character of those storms, has been to procure a number of copies of clean charts of the Atlantic, and to map out all the facts which I was able to collect in relation to any one of these storms, upon one of these charts, in their true time and location, so as to obtain a connected view of these facts, both as regards their consentaneous and consecutive relations. The results have been highly satisfactory—so much so, indeed, that I have not met with the statement of a single fact which is at variance with the explanation which I have given of the operation of these storms, *except in two or three instances, which proved, on further inquiry, to have been erroneously stated.* The historical records of more than a century past have been freely resorted to, and the inquiry has also been extended to other coasts and seas, and has shown the existence of an unvarying system, which I have not yet attempted to describe, except in the most summary manner.

It may well be supposed that, in pursuing this inquiry by the method of a simple induction of particulars, as here stated, I have not been able to preserve an unshaken confidence in some of those "received theories," which appear to have been founded on vague gene-

* American Journal of Science, vol. xx., p. 17-51; vol. xxi., p. 191-3; vol. xxv., p. 114-121.

ralizations, or unproven and untenable hypotheses; and I can hardly think that the reasonings which have at various times been adduced in support of these theories, from the time of Halley downwards, can be deemed either conclusive or satisfactory by any unbiassed mind, that shall give them a strict and impartial examination.

The grand error into which the whole school of meteorologists appear to have fallen, consists in ascribing to heat and rarefaction the origin and support of the great atmospheric currents which are found to prevail over a great portion of the globe. Nor is it necessary to perceive, or point out, an adequate and undeniable physical cause for the production of these phenomena, before we can discover the inconsistency and fallacy of the reasonings by which the old system of meteorology has been supported. Such a cause, however, I consider, is furnished in the rotative motion of the earth upon its axis, in which originates the centrifugal and other modifying influences of the gravitating power, which must always operate upon the great oceans of fluid and aerial matter which rest upon the earth's crust, producing, of necessity, those great currents to which we have alluded.

I have long entertained this conviction, but do not remember to have seen this great physical influence recognised in any degree, in its application to this subject, except by Sir John F. W. Herschell, in the third chapter of his popular treatise on astronomy,* where, by the aid of this rotative influence, he has been able to give us the most imposing support of the received theory of winds which has ever appeared, and in which the connection of the trades with the returning westerly winds, is, with some exceptions, correctly developed. Sir John, however, has erred, like his predecessors, in ascribing mainly, if not primarily, to heat and rarefaction, those results which should have been ascribed solely to *mechanical gravitation*, as connected with the rotative and orbital motion of the earth's surface, the influence of which he partially recognizes in connection with this and another subject of inquiry. I may also add, that, had this able philosopher been fully conversant with the facts which relate to the *course* and other phenomena of hurricanes, he would probably have withheld the hypothesis which he has given in a note appended to the chapter which I have alluded to, although one of the principal suggestions in this note has, undoubtedly, a proper connection with the subject.

As I can but seldom allow myself to enter upon the discussion of these matters, the preceding suggestions may be taken for what they are thought to be worth by those under whose notice they may chance to fall; but, to prevent being misunderstood, I freely admit that heat is often an exciting, as well as modifying, cause of *local* winds, and other phenomena, and that it has an incidental or subordinate action (though not such as is usually assigned) in the organization and development of storms, and that, in certain circumstances, it influences the interpositions of the moving strata of the atmosphere. Its greatest direct influence is probably exhibited in

* Art. 179 to Art. 200.

what are called land and sea breezes, or in the diurnal modifications which are exhibited by regular and general winds. But, so far from being the great prime mover of the atmospheric currents, either in producing a supposed primary north and south current, or in any other manner, I entertain no doubt that, if it were possible to preserve the atmosphere at a uniform temperature over the whole surface of the globe, the general winds could not be less brisk, and would become more constant and uniform than ever.

New York, April 8th, 1835.

Experiments on the Efficacy of Perkins' Steam Boilers, or Circulators. By A. D. BACHE, Prof. of Nat. Philos. and Chem., University of Pennsylvania.

TO THE COMMITTEE ON PUBLICATIONS.

GENTLEMEN,—The following experiments were made soon after the description of the new steam boiler or circulator of Perkins, reached this country; they were undertaken at the request, and for the satisfaction, of my friend, Mr. M. W. Baldwin, and I did not at the time make them public, because it was understood that this boiler would receive a full trial, on a proper scale, upon locomotives in England. From an article in a recent number of the *London Mechanics' Magazine*, I infer that the results of these experiments have not been stated, except in the newspaper paragraphs which we have seen here. As the results of my experiments were not particularly favourable to those circulators, it is probable that their publication may elicit further information in regard to the trials made in England; and at all events they will furnish, while uncontradicted by experiments on a larger scale, approximate indications of the performance of the boilers in question.

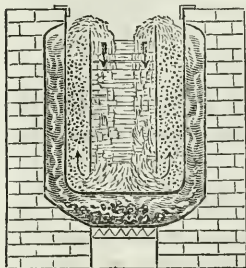
The following description of and remarks on the steam boiler of Mr. Perkins, is extracted from an anonymous pamphlet, entitled "*Steam Navigation. Improvements by Jacob Perkins. Part I. The Boiler.*"*

"To a boiler is fitted a hollow lining, not extending throughout the boiler, but in proportion to circumstances, in order that a strong circulation in the water may be caused, and that, by driving a perpetual current forcibly against the inner surface of that portion of the boiler exposed to the fire, the whole of the heat may be taken up by the water. And here must be recorded the result of farther experiments. If two vessels be filled with water, one of them placed within the other, and heat be applied to the outer vessel in such a manner that none can reach the inner vessel, except through the water contained in the outer one, no steam bubbles can be made to arise in the inner vessel, whilst, in the outer one, steam bubbles are formed rapidly. The fluid in the outer vessel being composed of a mixture of bubbles and water, that in the inner vessel being water alone, the contents of

* See also *Journal of the Franklin Institute*, vol. xi., p. 47, January, 1833.

the two vessels, although of the same temperature, are of different specific gravities, the mixture of water and bubbles in the outer vessel is lighter than the unmixed water in the inner vessel."

"Now if, of the inner vessel, the bottom be taken out, leaving the vessel open at top and bottom, but so placed as to be kept full of water, having its upper edge nearly level with the water surface in the larger vessel, and its lower edge supported at a moderate distance above the bottom of the larger vessel, as shown in the annexed diagram,—the unequal specific gravity of the fluid, when exposed to the action of the fire, will cause it to move in a circulating current."



"The bubbles contained in the water of the outer vessel, adjoining the fire, will rise continually to the surface with a power, when at a low temperature, somewhat exceeding the difference in the specific gravity of air and water; but if the number of bubbles be increased by additional heat, the difference between the respective specific gravities will be increased also, inasmuch as a larger quantity of vapour will be present in the water between the inner and the outer vessel, and the rapidity and force of the upward action will augment in a proportionate ratio; and if the heat be greatly increased, augmenting the relative proportion of steam bubbles, still more rapid and powerful will be the force and rate of their current to the surface, (their bursting and giving off the vapour conveyed in them,) whilst the water, in contact with the bubbles, partaking of their influence, will rise in a current also, having a tendency to produce a vacuum in the lower portion of the boiler. At the same time, the fluid in the inner vessel being unmixed with bubbles of vapour, or steam, will, by its greater specific gravity, descend, and continually arrange itself under the rising columns of the outer vessel, and so produce a circulating current."

"Thus may water be converted into steam four times faster than by the common method; or, in other words, by an apparatus of this kind, of one-fourth the size and weight of an apparatus of the common kind, an equal quantity of steam of any required power can be made in a given time, saving

Three-fourths of the space occupied by the ordinary apparatus,

Three-fourths of its weight, and

Three-fourths of the inconvenience and danger arising from its bulky contents of heated water."

In the trials of this boiler, a cylinder was used, $2\frac{1}{2}$ inches in diameter, and terminated by a curved end; the whole length, along the axis of the cylinder, from the mouth to the bottom of the vessel, being $4\frac{3}{6}$ inches. Within this was placed, in the first experiments, a second vessel of the same general figure, $1\frac{1}{2}$ inch in diameter, and $2\frac{1}{8}$ inches in depth, and having an opening in the bottom to allow the circulation of the fluid.

The space between these vessels was one-half of an inch across,

perpendicularly to the surfaces. The inner vessel was suspended from the mouth of the outer one by wires, which kept it in its place. Both vessels were of copper, about $\frac{1}{32}$ of an inch thick.

The opening in the lower part of the inner vessel was made at first half an inch in diameter; it was subsequently enlarged, until it occupied the entire section of the inner cylinder; this inner vessel was then changed for a second having a less diameter.

Two methods of applying heat were adopted: the first was by using a large double wickd spirit lamp, of the kind invented by Doctor Mitchell; the second by a charcoal furnace.

When heat was applied to the small boiler without the inner vessel, or circulator, the boiling took place over the whole upper surface of the liquid; when the inner vessel was in its place, foam formed only in the annular space between the two vessels, while the water contained in the inner vessel was tranquil. When the upper surface of the water fell to the level of the top of the inner vessel, the foam which formed in the annular space rose up, and poured over into the inner vessel. The circulation described by Mr. Perkins did take place, but there is obviously a question whether it was more rapid than when the currents of water were allowed to take their natural course, without being restrained to certain paths; and if more rapid, still the efficacy of this artificial circulation, in producing steam, must depend upon whether the natural circulation is insufficient to carry off the heat as fast as it is imparted by the fire beneath the boiler.

In the first comparative experiment, the following plan was pursued.

A measured quantity of water was placed in the cylinder, the circulator being in its place; an alcohol lamp, before alluded to, having the wicks previously saturated with alcohol, and a measured quantity of alcohol then poured into it, was placed under the boiler, and lighted, the time being noted; the time at which the water began to boil was observed; water was allowed to drop slowly, from a vessel containing a measured quantity, into the middle of the cylinder, so as to supply, at least in part, the waste from the production of steam. When the experiment had continued thirty minutes, the lamp was extinguished, the boiler placed in a vessel of cold water, to cool the water in it rapidly, and its contents measured; the alcohol was poured from the lamp, and measured; and the water remaining in the supply vessel, measured. The temperatures at which all these measures were taken, were made as nearly uniform as was convenient; as minute accuracy was not desired, no reductions have been made for the temperatures, which were, however, observed, that they might be kept within proper limits.

From the ascertained deficit of water in the supply vessel, and in the boiler, the quantity converted into steam was known; from the time required to raise the water in the boiler to the boiling point, which was observed, an approximate value of the time required to raise the supply water to ebullition, was calculated; this time, subtracted from the observed time, during which the whole liquid was

boiling, gave the time required to convert into steam the quantity of water which had disappeared. The alcohol consumed was known from the quantity remaining in the lamp, after the experiment; and the amount of alcohol consumed in converting the water into steam, was known by comparing the whole duration of the experiment with the time, just found, required to convert the water into steam. The elements of comparison were then at hand, viz: the time required to convert a given quantity of water into steam, with a given expenditure of fuel.

The results of the first comparison were as follows.

Comparison of a Vertical Cylinder Boiler, with and without a Circulator.

	With inner cylinder, $1\frac{1}{2}$ in. diam. aperture $\frac{1}{2}$ in.	Without inner cylinder.
Observed Quantities.		
Water in boiler at beginning of experiment,	9.75 meas'rs.	9.75 meas'rs.
“ end,	6.00	5.06
Differences, or quantity consumed less the supply,	3.75	4.69
Water in supply vessel at beginning of experiment,	2.00	2.00
“ end,	0.41	0.75
Difference or supply, to be added to the difference obtained above,	1.59	1.25
Water converted into steam, (1.59 + 3.75)	5.34	(1.25 + 4.69) 5.94 meas'rs.
Alcohol consumed in the experiment,	3.22	3.63
Time from beginning of experiment to ebullition,	490"	470"
Whole time of experiment,	1800"	1800"
Calculated Quantities.		
To raise the supply water to ebullition,	80	60"
Time required to boil away 5.34 measures of water, being (1800—490—80)	1230"	5.94 measures, (1800—470—60) 1270"
Would have boiled away in 1800" or 30',	7.81 meas'rs.	8.42 meas'rs.
Alcohol consumed in 1800",	3.22	3.63 meas'rs.
Would have boiled away in 30', with a consumption of 5 oz. of alcohol,	12.13 meas'rs.	11.61 meas'rs.
Ratio,	1.04	1.00

The calculations made in the foregoing table are simple proportions, and, therefore, probably, require no illustration. For the

purpose of comparison, the quantity of water which would have been vaporized in 30', is deduced from the quantity vaporized in the time given by the experiments; and from the alcohol consumed in 30', to vaporize the calculated quantity of water, the quantity which would have been converted into steam by five measures of alcohol, supposed to be consumed in 30', is deduced.

The only quantity in the foregoing table which is not strictly deduced, is the time required to raise the water supplied, to the boiling point; this is calculated from the observed time required to raise the water in the boiler to the boiling point, whereas, the water being gradually introduced into the midst of boiling water, would probably require a different time. The allowance is in the proper direction, and inconsiderable in amount, and, therefore, does not sensibly diminish the accuracy of the approximation.

In the following experiments, charcoal was used as a fuel. A tin vessel about ten inches in diameter, and ten in height, was converted into a furnace by piercing it, about two inches from the bottom, with holes, through which thick wires were passed to support the fuel; an aperture for the draught was made below the bars. Two wire handles, in planes at right angles, were attached to the upper edge of this furnace, the handles being united by a wire hook, which served to attach the furnace to a scale beam.

A weight was first applied, sufficient to balance the furnace; fire was then made, and the furnace and contents being weighed, the weight of the latter was ascertained. In practice, it was found convenient to use always the same weight of fuel. Weighed parcels of charcoal were provided to add to the furnace during the experiment. The fire being in full combustion, and the regulated weight of fuel being in the furnace, the boiler, containing a measured quantity of water, was placed in the midst of the fuel; the other arrangements were as formerly stated,—the time which was required to raise the water to ebullition being observed, and also the time of duration of the experiment, which was usually about half an hour. The supply of water introduced, and the quantity vaporized, were ascertained, as before described. The experiment being terminated, the boiler was rapidly transferred into a vessel of cold water, and the furnace to the scale beam, the weighing being made as rapidly as possible, to ascertain the fuel consumed; account was, of course, taken of the quantity added during the experiments, and an attempt made to render this as nearly uniform as possible.

The balance which was used, turned readily with .05 of an ounce troy, and detected instantly the loss of weight by combustion, when the furnace, having burning fuel in it, was balanced upon the beam.

In the first experiments, the boiling carried a small portion of water over the sides, to remedy which, an extra cylinder, of an inch and a half in height, was added to the first described; notwithstanding this, the ebullition caused by the charcoal was so much more violent than that by the lamp, that, in the first experiment made, much water was carried over in foam; on this account, an additional

vessel, funnel shaped, and about three inches high, was placed upon the former, completely remedying the defect noticed. A tin disk was placed around the boiler, at the level of the original vessel, to prevent it from sinking further than this level in the furnace.

The heat lost in this furnace by radiation, contact, &c., while it would affect a theoretical question, makes this form of experiment represent more closely the case in practice.

In the following two comparative experiments, no water was supplied; the measures are fluid ounces, and the weights ounces troy.

Table of Comparative Experiments, with and without Circulator.

Observed Quantities.	With inner cylinder, as in the first experiment.	Without inner cylinder.
Water in the boiler at the beginning of the experiment,	11.00 fl. oz. at 53½° F.	10.00 fl. oz. at 53½°
“ “ end,	1.12 “	0.87 “
Water vaporized,	9.88 “	9.13 “
Coal consumed,	5.72 oz.	5.25 “
Time required to vaporize the water,	1670 secs.	1467 secs.
Time elapsed during the entire experiment,	2170 “	2047 “
Calculated Quantities.		
Water which would have vaporized in 30',	10.64 fl. oz.	11.19 fl. oz.
Fuel consumed in 30',	4.75 oz.	4.62 oz.
Water which would have vaporized in 30', by 5 oz. fuel,	11.20 fl. oz.	12.11 fl. oz.
Ratio,	0.93	1.00

In one part of this experiment, when the water was low, the foam raised by the ebullition occupied the inner cylinder, being in its place, twenty times the bulk of the water then in the boiler. The experiment did not represent, with entire fairness, the effect of the circulator, having been continued after the water was very low; this fact did not appear until, the experiment having been stopped, the foam was allowed to subside.

In the trials which follow, water was introduced slowly, as at first, a small float being used to endeavour to maintain a constant level.

The following table gives a comparison with the same inner cylinder, and without it. The quantities are arranged as in the first table.

Table of Comparison of Boiler, with and without Circulator.

Observed Quantities.	Inner cylind. 1½ in. diam., aperture ½ in.	Without inner cylinder.
Water in boiler at beginning of experiment,	11.00 fl. oz.	11.00 fl. oz.
“ “ “ end “ “	9.75 “	14.87 “
Difference,	1.25 “	3.87 “
Water in supply vessel at beginning of experiment,	20.00 “	20.00 “
“ “ “ end “ “	13.82 “	8.69 “
Difference,	6.18 “	11.31 “
Water vaporized, (6.18 + 1.25)	7.43 “	7.44 “
Charcoal consumed,	4.45 oz.	5.00 oz.
Time from beginning of experiment to ebullition,	520 secs.	500 secs.
Total duration of experiment,	1680 “	1800 “
Calculated Quantities.		
Time required to raise to ebullition the supply water,	292 secs.	513 secs.
Time required to vaporize the quantity of water above stated,	860 “	787 “
Quantity of water which would have been vaporized in 30',	15.40 fl. oz.	17.02 fl. oz.
Fuel consumed in 30',	4.77 oz.	5.00 oz.
Water which would have been vaporized in 30', by 5 oz. charcoal,	16.15 fl. oz.	17.02 fl. oz.
Ratio,	0.95	1.00

The opening at the bottom of the inner vessel was next enlarged to $\frac{1}{10}$ ths of an inch, and finally the bottom of the vessel was cut off, thus giving the full area of the cylinder for the opening of the circulator. The following table contains the comparisons.

Table of Comparison of two Circulators, of different openings.

Observed Quantities.	Inner cylinder 1½ in. Apert. 15-16ths inch.	Inner cylinder 1½ inch. Aper- ture 1½ inch.
Water in boiler at beginning of experiment,	11.00 fl. oz.	11.00 fl. oz.
“ “ end, “	8.93 “	11.62 “
Difference,	2.07 “	0.62 “
Water in supply vessel at beginning,	20.00 “	20.00 “
“ “ end, “	12.72 “	12.06 “
Difference,	7.28 “	7.94 “
Water vaporized,	9.35 “	7.32 “
Charcoal consumed,	5.40 oz.	4.75 “
Time from beginning to ebullition,	603 secs.	508 secs.
Whole duration of experiment,	2100 “	1820 “
Calculated Quantities.		
Time to raise supply water to ebullition,	399 secs.	367 secs.
“ vaporize water above stated,	1098 “	945 “
Water vaporized in 30',	15.33 fl. oz.	13.94 fl. oz.
Fuel consumed in 30',	4.63 oz.	4.70 oz.
Water vaporized in 30', and with 5 oz. fuel,	16.56 fl. oz.	14.83 fl. oz.

The next trials were made with a smaller cylinder, used as a circulator, three-fourths of an inch in diameter, and without bottom. This failed to answer any good purpose, as might have been expected; it is unnecessary, therefore, to give the details.

A recapitulation of the results obtained in the foregoing experiments, is given in the annexed table.

Comparison of Experiments with a vertical Cylinder Boiler, without and with an interior Circulator.

Alcohol as fuel.		Charcoal used as fuel.					
		Without supply of water.		With nearly constant level of water.			
				Without inner cylinder.	With inner circulator.		
					Diam. of apert. in bottom of inner cylin.		
With inner cylinder.	Without inner cylinder.	With inner cylinder.	Without inner cylinder.	Without inner cylinder.	$\frac{3}{4}$ of an inch.	15-16ths of in.	1 $\frac{1}{2}$ inch.
12.13 meas	11.61 meas	fl. oz. 11.20	fl. oz. 12.11	fl. oz. 17.02	fl. oz. 16.15	fl. oz. 16.56	fl. oz. 14.83
1.04 "	1.00 "	0.93	1.00	1.00	0.95	0.97	0.87

The inference from this table is obviously that, so far from producing any important effect in promoting the generation of steam, the inner cylinders, or circulators, did not even effect a sensible increase in the quantity of water vaporized in a given time, and with a given quantity of fuel. The diminution of five, and three per cent. observable in the last two columns of the above table, and the gain of four per cent. in the first column, are clearly within the limits of the approximations which the experiments furnish.

FRANKLIN INSTITUTE.

Quarterly Meeting.

The forty-fifth quarterly meeting of the Institute was held at their Hall, on Thursday evening, April 16, 1835.

Mr. JOHN HORTEN was appointed Chairman; and

Mr. EDWARD H. GILL, Rec. Sec. P. T.

The minutes of the last quarterly meeting were read and approved.

Donations of books were received from the Society for the Encouragement of Arts, Manufactures and Commerce, of London; Professor Faraday, of London; Councils of the city of Philadelphia; the

Geological Society of Pennsylvania; Hon. James Harper; George Fox, Esq., Mr. Wm. W. Smith, Mr. M. W. Baldwin, and Messrs. Carey, Lea & Blanchard, of Philadelphia.

Donations to the cabinets of models and minerals, were received from—

Robert Pettit, Esq.; John C. Trautwine, Esq.; Messrs. Lehman & Duval; Mr. Jos. S. Walter, Jr.; Mr. Richard Oakford, and Mr. E. C. Biddle, of Philadelphia.

The actuary laid on the table, the various periodicals received during the last quarter, in exchange for the Journal of the Institute.

The chairman of the Board of Managers presented their quarterly report, which was read and accepted, and referred, for publication, to the Committee on Publications.

The Treasurer presented his report for the last quarter, which was read and accepted.

A communication from the American Lyceum, inviting the Institute to attend, by delegates, their fifth annual meeting, was presented and read; when, on motion, the Corresponding Secretary was instructed to acknowledge the receipt of the invitation.

Extract from the minutes.

JOHN HORTEN, *Chairman.*

EDWARD H. GILL, *Rec. Sec. P. T.*

Forty-fifth Quarterly Report of the Board of Managers of the Franklin Institute.

The Board of Managers respectfully submit to the Institute, the following report of their operations for the last quarter.

Immediately after their organization, the several standing committees were appointed, and they have since been actively and zealously engaged in the performance of the duties entrusted to them.

The Library is a subject of deep interest to the members of the Institute, and the Board are happy to announce that it is slowly, though steadily, increasing, and that, during the last quarter, a number of valuable additions have been made to it, of practical and scientific works.

The Lectures of the Institute were closed on the 25th of March last; the large number of the class, and their regular attendance during the season, clearly evince the interest taken by the members and the public in this method of popular instruction, which, the Board indulge the hope, will long continue. The disorderly conduct of minors, so much complained of in former years, was, in consequence of the efficient measures adopted by the committee on instruction, at the commencement of the lectures, entirely prevented. The Board of Managers cannot but express their acknowledgments to the several professors and lecturers, for the zeal and ability they have displayed in the service of the Institute. The unusually large number of pupils in attendance at the drawing and English schools, is an evidence that their importance, and the beneficial influence they

will exert upon the rising generation, are properly and duly appreciated.

During the last quarter, some additions have been made to the cabinet of models. The committee on minerals are actively engaged in the classification and arrangement of those in the possession of the Institute, which, it is believed, will soon be completed.

A large portion of the time of the Committee on Publications, has been industriously devoted to the improvement of the Journal, and its high reputation, not only throughout our own country, but also in Europe, should, in the opinion of the Board, induce the members of the Institute, and the public generally, more extensively to encourage and patronize it.

The list of premiums for the exhibition in October, 1835, reported by the committee on that subject, and adopted by the Board, will be found to embrace a greater variety of objects than that of any former exhibition of the Institute. It has been printed, and will, together with an address to the manufacturers and mechanics of the United States, be extensively distributed. To awaken and create a laudable spirit of emulation and improvement, has always been the principal object of the exhibition of articles of domestic manufacture, and the Board rely with great confidence upon the support and co-operation of the mechanics and manufacturers of Pennsylvania, and of the United States, to render the exhibition of this year as interesting, attractive, and useful, as those of preceding years.

The Committee on Science and the Arts have continued their active and useful labours. The number of members has increased, and the interest in their meetings and reports is fully sustained. During the past quarter, this committee have recommended to the managers the award of two premiums and medals from the Scott's legacy fund,—one to Philos Tyler, of Philadelphia, for the invention of a shifting gauge cock for steam boilers; the other to Thomas Ewbanks, of New York, for an improved method of tinning lead pipes. These awards have been confirmed, subject to the rules of the committee.

The committee, at their annual meeting, re-elected Prof. A. D. Bache their chairman for the ensuing year.

The monthly meetings have been regularly held, and numerous attended. The reading room continues also to be much frequented, but the necessity of a livelier and deeper interest in this is much felt, in order to make it of extensive utility and benefit.

During the past quarter, Mr. H. R. Campbell has been admitted a life member.

All which is respectfully submitted.

GEORGE FOX, *Chairman.*

WILLIAM HAMILTON, *Actuary.*

Monthly Conversation Meeting.

The sixth conversation meeting of the Institute, for the season, was held at their Hall, March 26th, 1835.

Messrs. B. Slater & Co. exhibited two hatchets, made by Joel Howe, of Princeton, Mass. which were much admired for their finish.

Messrs. Carr & Lunt exhibited the following highly approved articles,—A specimen case of castors, made by H. Huntington, Jr., of Hartford, Conn.; a gimlet, by J. H. Mather, of Deep run, Conn.; and a catch for window sashes, by N. & A. M. Goodyear, of New Haven, Conn.

There was laid upon the table, from Richard Oakford, Esq., a specimen of Payta cotton, accompanied by a letter, stating the particulars of the growth of the tree which yields this article, and the peculiarities of the cotton itself. The specimen closely resembled fine wool.

Professor Johnson exhibited some alcohol and mercurial thermometers, constructed by him, of large size, and admitting of graduation to hundredths and even two hundredths of a degree, Fahrenheit. He showed a curious fact, not noticed in descriptions of the thermometer, namely, that the first effect of heat on one of these instruments, is to cause a fall in the liquid, and the reverse on reducing the temperature; effects produced, as was explained, by the expansion and contraction of the glass. Professor Johnson also showed a thermometer with an oblong bulb, containing within it a second bulb, hermetically sealed, leaving but a small space between the two, and thus exposing considerable surface, compared with the mass of the liquid.

A model of a rotary steam engine, by Dr. Ethan Baldwin, of Washington city, was submitted for inspection.

A model of a canal boat, with a peculiar propelling apparatus, invented by W. Bush, of White Marsh, was placed in the room. This model has been submitted to, and reported upon by, the Committee on Science and the Arts.

Prof. A. D. Bache explained certain methods devised by him for illustrating the radiation and absorption of heat by different surfaces, the conducting power of solids, &c. The articles of apparatus exhibited are described in the last number of this Journal.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN NOVEMBER, 1834.

With Remarks and Exemplifications, by the Editor.

1. For a *Machine for Thrashing Grain, and Picking Hair and Wool* for upholsterers; Joshua Bean, Readfield, Kennebeck county, Maine, November 5.

There are, in this machine, four beaters, which are segments of a cylinder of a foot in diameter; they are fixed upon arms, and are made of wood, each of them being three inches wide, and covered with sheet iron, punched so as to form a grater. The spaces between the beaters are open. A concave, placed at the distance of about half an inch from the circle formed by the revolving beaters,

is also covered with punched sheet iron, this concave being made adjustable.

The patentee claims as his "invention, the open beater, or fly wheel, the general form and operation of the machine, and the application of the principles developed in this specification, to the purposes for which the machine is described."

This claim sounds very well, but as open beaters are very common things in thrashing machines, and as the principle developed in the specification has not been rendered visible to us, we cannot find any thing in the whole that appears original. At p. 110, we have given the specification of a very similar machine, for picking curled hair, in which teeth are placed in rows upon a cylinder, leaving void spaces between the rows. In our opinion, these machines are *substantially* the same, and how much they differ from some of the thrashing machines described on our pages, we leave the reader to judge; that above alluded to was not claimed as applicable to thrashing, and the iron graters on the one before us we do not think well adapted to this purpose.

2. For *Stoves for Burning Anthracite*; Denison Olmsted, New Haven, Connecticut, November 5.

(See specification.)

3. For an improvement in *Axles and Boxes for Rail-road Cars*; Dexter C. Force, and Frederick Davis, city of Baltimore, November 6.

The axle is to be turned and made true in the usual way, and upon it is to be placed a metal ferule, or tube, fitting it exactly. The wear from running is to be between the ferule and the box contained in the hub of the wheel, so that no wear whatever shall take place on the axle itself.

The material of which the ferule, or tube, is to be made, is not particularized, but it is said that it may be "either of composition, or of iron made case hardened." There is no claim, but it is sufficiently plain that the patent is taken for the using of the ferule, or tube, between the axle and the box.

4. For *Thorough Braces for Carriages and Rail-road Cars*; Frederick Davis, city of Baltimore, Maryland, November 6.

These thorough braces are to be made either of wood or of iron, although the latter appears to be preferred; it is to be of the kind called band iron. The brace is to extend along under the lower side timbers of the carriage, like those of leather, and is to have one or two hinge joints near its middle, where the body is to be attached to it. To strain, or take up the brace, there may be shackles at the ends, where it is attached to the jacks, furnished with a tightening screw and nut. Sometimes the brace is made double at each end, a

piece, forming a strap, being attached to each jack; these pieces, and the ends of the braces, have rows of holes, through which bolts may pass, and by sliding these upon each other, the bolts may be passed through different holes, and the length of the brace be thereby regulated.

"The improvements to which I lay claim as original, are the forming the entire brace of iron, other metal, or wood, in the peculiar manner I have described, so jointed and attached to the body, as that it may be free to act on it without obstruction, when jolted or put in motion by the roughness of the road; and also the application of it to all descriptions of carriages or rail-road cars, where thorough braces are required; also the application of the screw and the fixtures described, to carriages where body loops are used, so as to raise and lower a body at pleasure, and to give a pleasant motion to the vehicle, without the use of the leather braces heretofore employed."

5. For *Bee Hives*; Abial Whitman, Londonderry, Windham county, Vermont, November 6.

The object aimed at in this hive, is so to construct it that millers may not deposit their eggs at its entrance, and thus to prevent the destruction of the bees and honey by those insects. The hive is to be made of five pieces of board, two of which, forming the ends, are triangular. Two pieces of board, sixteen inches wide, one of them three feet, and the other two feet six inches long, are nailed on to two sides of the triangular ends, but so as to leave an open space of about three-eighths of an inch at the angle, through which the bees are to enter. This angle is to be placed downwards, the sides resting against parallel bars. A piece of board nailed on the top forms the roof, which, in consequence of the unequal length of the two sides of the triangle, has the requisite slope. There being "no platform, as heretofore used, to support the hive, upon which, in the filth collected at the bottom of the hive, the millers deposit their eggs."

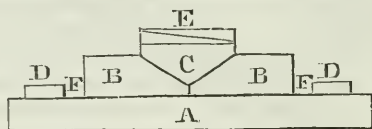
6. For *Blocks for Docking and Building Vessels*; John Williston, Portsmouth, Norfolk county, Virginia, November 6.

The description of these blocks is brief, the whole substance of it being as follows: 1st. A ground block of convenient size for the intended purpose, lying horizontally, and at right angles to the direction of the keel. 2d. A rider block surmounting the ground block, and divided into equal parts by a vertical cunifform section, the faces inclined to each other at an angle of about one hundred and twenty degrees; strong cleats are to be firmly secured to the upper surface of the ground block, to prevent the separation of the rider block at the cunifform section; a space is to be left at each end, sufficiently large for the reception of married wedges. 3d. Two alternate, or married, wedges, equal in length and breadth to the cunifform section, and resting thereon.

These blocks, if used in a dock, are to be well secured to the

floor, to prevent their rising on the admission of water. The vessel is to be carefully placed upon the centre of the alternate wedges, if used, as the water is withdrawn, or otherwise on the centre of the cuniform section. When a block is to be removed, the married wedges between the cleats and the ends of the rider are to be withdrawn, and the cuniform section will then fall sufficiently low. The alternate wedges resting on the cuniform section, are to be used when deemed expedient, to give greater support to any particular part of a vessel than could be imparted by the wedges at the ends of the rider.

We give a sketch of the arrangement, to enable those concerned to judge of its novelty and utility, the patentee not having designated, as he should have done, the points upon which his claim to invention is dependent. A is the ground block; B, the riders; C, the cuniform section; D, cleats; E, wedges; F, spaces for wedges at the ends.



7. For *Wrought Iron Door Handles*; Harlow Isbell, Meriden, New Haven county, Connecticut, November 8.

The improvement claimed is in the form of the handles of what are called Norfolk latches. These handles, it is said, ought to swell in the middle part, but to obtain such swell on wrought iron requires considerable labour; to obviate this disadvantage, the handle, made of rod iron, is to be placed in a proper mould, and metal of any suitable composition to be cast around it, which may be done in the form of mouldings, or otherwise.

The claim is to "the addition of one or more enlarged parts to a common wrought iron door handle, by means of a metallic substance cast around the same."

8. For an improvement in *Door Handles*, usually called Norfolk latches; Harlow Isbell, Meriden, New Haven county, Connecticut, November 8.

In this handle, the part which is to be grasped in the hand is to be of cast-iron, and, with the exception of the swell caused by the pattern, or moulding, it is to be straight from end to end. Two short pieces, or studs, of wrought iron connect the handle with the plate; these are embraced at one end in the cast-iron, and by the other may be riveted to the plate. The iron forming the handle referred to in the preceding patent, is bowed, or curved; in this, the handle part is parallel with the plate, its ends being at right angles thereto.

The claim is to the forming the part particularly called the handle, by the combination of cast and of wrought iron, in the way described, whether the two are united by casting, or by riveting, screwing, or otherwise.

9. For a *Machine for Hulling Clover Seed*; William C. Grimes, York, York county, Pennsylvania, November 8.

(See specification.)

10. For a *Machine for Hulling Clover Seed*; William C. Grimes, York, York county, Pennsylvania, November 8.

(See specification.)

11. For an improvement in *Screw Augers*; Raymond French, Derby, New Haven county, Connecticut, November 11.

This is said to be an improvement on screw, pump, and spur augers, and consists in giving to the plates which are to be twisted, a longitudinal, concave surface, so that the plate, as well as the pod, when twisted, shall be thinner at the centre than at the edges, either by a regular curvature, by a diminution of thickness formed by straight lines, or by lines in part curved, and in part straight.

"All that I claim as my invention in the foregoing improvement, is, the principle and its application to use, of constructing the plate and pod of screw augers and bits, thicker upon the edges than in the middle, under the modifications, and in the manner above specified, and that the same principle and form may be applied to all tools used for boring holes in wood or timber, having a twisted pod, and two spiral semi-cylinders."

The advantage derived from this construction is said to be, that it gives to the spiral cavities of the pod, when twisted, a greater capacity towards the inner surface, and more perfectly envelopes the core, or chips, within a metallic surface, in their passage from the bottom to the top of the hole while boring, by which they are caused to rise and flow off more freely and rapidly. A coarser screw than usual may, it is also observed, be given to an instrument of this construction, and its strength and durability are increased from the manner of distributing the metal.

12. For a *Thrashing Machine*; Stacy West, Hartford county, Maryland, November 11.

(See specification.)

13. For an improvement in the *Hydrant*; Jacob Stroop, Allegheny, Allegheny county, Pennsylvania, November 11.

The main object to be accomplished by the machinery here patented, is not expressed either in the petition or the specification; this object is, however, to withdraw the water from the discharge pipe in hydrants, so as to prevent its freezing.

In vol. xiii., p. 405, we have given the specification of a patent for a similar machine, obtained by Messrs. Laning and Newton, on the 30th of July, 1833; and at p. 392 we have noticed one granted to Mr. Stroop, on the 16th of December of that year, for a contrivance exactly resembling it in principle. In the patent before us, he has

given another modification of the same thing, without, however, alluding to his former patent, or pointing out the improvements claimed in the present; in fact, there is not any claim appended to it. For the general principle of action, we refer to Laning & Newton's specification. So far as dates are concerned, the presumption is that they were the first inventors, and the variations introduced by Mr. Stroop do not, certainly, constitute his a new machine.

14. For *Combined Levers*; Caleb Tompkins, Montgomery, Montgomery county, Alabama, November 14.

We do not know that our title will be approved by the patentee, but the length of it, as given by him, forbade its finding a place in the heading; not to delay justice, however, we now give it in extenso:—*"A new and useful application of principles, consisting of cross bars, cross levers and ends, and cross and single levers; bars; shafts; pieces; tumbling bars; balances; action horizontal; perpendicular, rotary, reciprocating, surface and central action of lever powers; simpleness and economy in its useful principles, which has not heretofore been used or known."* The preceding is from the title in the petition, which, it appears, was not sufficiently comprehensive, as we have a further enumeration in the specification, as follows:—*"Principles of action, and power on levers, cross bars, cross bars combined, levers, cross levers, cross bars, and ends, and cross ends, crank, shaft, bars, pieces, tumbling bars, centre and surface of balances, connecting pieces, bolts, screws, nuts, axles, axle centre box, sliding bolt, bar slide, wheel bar, ways for action, centre and surface, horizontal, perpendicular, rotary, circular, reciprocating, alternate, to and fro, backward and forward, up and down, inward and outward, acting and agreeing in their respective actions."*

To write a good book, nothing more is requisite than to know how to arrange the letters of the alphabet into suitable syllables, words and sentences; and in like manner, if a man cannot make a good machine when he has all the elements, objects, and means of motion, placed before him, it must be because he does not know how to combine them together.

It will scarcely be credited, after the long array of motive parts which the patentee has laid before us, that, when combined together according to the pattern existing in his imagination, and whilst we are looking for something almost "instinct with life," he should present us with nothing more than the antiquated contrivance of "lazy tongs;" yet such is the fact. There may be some of our readers who are unacquainted with the instrument so called, and for the sake of such persons, we will state that they consist of a number of cross bars jointed together at their middles, and at their ends, appearing thus $\times \times \times$; and having at one end bows, like scissors, and at the other, tongs, to take hold of a coal, with which to enable the smoker to light his pipe, without the necessity of rising from his seat. They now, however, are to be applied to a more noble purpose, and to beget power enough, were the crosses sufficiently numerous, to push the moon from her orbit, by the action of a thumb and finger.

We do not recollect how long it is since some learned mechanician conceived the same idea with the present patentee, and actually obtained a patent for its application; the book is upon our shelves which would tell all about it, but being under the influence of an idle fit, and not having a pair of lazy tongs with which to reach it, we shall not quote the chapter and verse.

This combination of cross bars, the patentee calls his "*PRIMUM-MOSHUN*," through the aid of which all the great ends that he contemplates are to be attained. We will give his concluding remarks, leaving it to those who wish for more than the beginning and the end of his specification, to apply at the Patent Office, where the whole is upon record.

"In all cases where and when deemed necessary to return some power and action of power, producing in the application of *primum-moshun* (or cross bars) to be conveyed and applied to the first moving cause or action, by an increase, or crowded action of power; say one lb. produces by machinery one hundred lbs. weight, or force; thereby increase and return of action of the part of the hundred lb. force to the one lb. (or a sufficient part) to produce an increase of crowded action, by ballance, lever, wheel, bar, or any piece of machinery constructed to produce the effect which is effected, either or combined according to their use and intentions of this power application."

15. For a *Rotary Engine*; Caleb Tompkins, Montgomery, Montgomery county, Alabama, November 14.

This machine is not a rotary steam engine, but a rotary *primum-moshun* engine, intended, of course, to carry the principles developed, or rather enveloped, in the preceding patent, into effect; the extraordinary nature of which has induced us to allow to it extraordinary space, but with the present we must be more brief; we, however, will give a quotation or two, for, although we do not understand the language in which the patentee writes, others may.

"This improvement represents the central action of axle of ballances by cranks on cross bars action or surface of ballances, or crank, producing leverage action and power, thus continued in proportion and number to increase any quantity of action and power designed to be obtained."

"This machine is intended to be applied to all kinds and description of use, and application of power, in agriculture, commerce, and manufactures, for mills, presses, hydraulics, locomotion, grinding, screwing, pounding, sawing, turning, raising water, ploughing, to draw and propel all kinds and descriptions of bodies or properties, propelling vessels that can be made to navigate the waters of the earth, or the fluids of the heavens."

Having conducted our inventor to a good place, there we leave him.

16. For a *Thrashing Machine, and Straw Cutter*; John Stewart, Cambridge, Dorchester county, Maryland, November 17.

This appears to be an unusual combination, but on examining the specification we find that, although it is claimed as such, it is not a combination in any sense of the word, but two distinct machines, neither of which is claimed, or rather each of which is disclaimed, by the patentee, as not being of his invention. A horizontal band wheel is to be turned by a horse, in the usual way, and this is to give motion to other band wheels and whirls, to drive a thrashing machine, attached to a suitable frame. When the thrashing machine is not wanted, it is to be removed from the frame, and that for cutting straw attached in its place.

The patentee says, "I do not claim to be the inventor of the thrashing machine, or the straw cutter, as both are public property; but what I do claim to be the inventor of, and for which I ask letters patent, is the combination of the two in one machine, and the general arrangement of the several parts, as above described." This seems to be something like a disjunctive conjunction.

17. For a *Thrashing Machine*; John Shaw, Augusta, Kennebeck county, Maine, November 17.

There are to be four beaters, set with teeth, and revolving like a horizontal reel. The teeth are to be of wrought iron, about half an inch square, and to project out from the wooden beaters, about three inches; similar teeth are to be driven into a concave, and the whole is to operate in the ordinary way; the principle of action is precisely the same with that of many other thrashing machines, the points of difference being mere matters of arrangement. The claim is to "the revolving beaters; the shape and structure of the iron teeth; the manner of applying the hand power, and the cheap and compact manner of constructing the feeding board, and whole machine."

18. For improvements on the *Water Wheel*, patented July 12th, 1834; William Kelly, Pittsburgh, Alleghany county, Pennsylvania, November 17.

We noticed the former patent at p. 99. Judging from the proposed improvement, we suppose that the patentee, upon attempting to carry his former plan into effect, found that his paddles would not assume the desired position; he has, therefore, complicated them, by the addition of a cross upon the axes, by which his compound paddles are suspended; and this cross is to come into contact with an iron arch, at the upper part of the wheel house, the action of which is to place them in the intended position. We are fully convinced that, in their improved state, these paddles will not operate better than the ordinary wheel, whilst they will be much more liable to be out of order.

19. For a *Thrashing and Winnowing Machine*; William Loughton, Portsmouth, Rockingham county, New Hampshire, November 17.

This differs from the great mass of thrashing machines in several particulars. Instead of a cylinder, there is to be a revolving, conical body, the axis of which is horizontal. This conical body may be three feet long, eighteen inches in diameter at one end, and ten at the other. It is to be channelled from end to end, so as to form upon it twelve, or any other convenient number of, angular teeth. A semicircular concave, adapted to it, and similarly grooved, occupies one-half its circumference, extending round from the top to the bottom. The driving apparatus is at the large end; the sheaves to be thrashed are passed between the cone and the concave longitudinally; that is, the straw end is to be held in the hand, in the direction of the axis of the cone, and the ears are to be passed through, by its revolution, the straw being still grasped; the grain, it is said, will be then removed entirely, and the straw remain unentangled, and unbroken. The winnowing part has nothing in it which requires description; the things claimed are the following.

“The conical ribbed cylinder, and the semicircular ribbed cradle, which, from their horizontal position, renders the labour of holding the straw less, and preserves it from being broken, and otherwise injured; the capacity of the cylinder and cradle to have any additional ribs necessary for shelling corn, and other coarser grain; and the method of letting the straw pass into the ribs lengthwise, by which the action of the ribs is upon the head or seed end of the sheaf, thereby splitting the hulls of the grain from end to end, instead of breaking them off.”

20. For a *Machine for Splitting Palm Leaf*; Charles Wadsworth, Barre, Worcester county, Massachusetts, November 17.

This machine consists of a cylinder of circular cutters, or knives, placed at a proper distance from each other, and which run against a second cylinder made of metal, not sufficiently hard to injure the edges of the knives. The two cylinders may be fixed in a frame like that of a flattening mill, with screws to adjust them perfectly to each other, and with cog wheels on the axes of the cylinders to cause them to revolve simultaneously.

There is not any claim made, nor do we think the machine new, although it is probable that it has never been applied to the splitting of palm leaf. Will not a machine of this description destroy the texture of the strips, by cutting them across the grain?

21. For a *Printing Press*; Adam Ramage, city of Philadelphia, November 19.

This is a press intended for small work, and a main object in its construction has been to render it simple, and consequently cheap, whilst it should be efficient for the purposes to which it is to be applied.

A bed, or platform, may be made of wood, to which are bolted the two ends of a wrought iron frame, that rises from it something in the form of a gothic arch. The carriage to support the form, frisket, &c., runs upon ways, and has a handle attached to it, by which it can readily be passed back and forth, under the platten. A vertical bar rises from the centre of the platten, through the top of the arch, its lower end being governed by a guide bar extending from one side of the arch to the other. The platten is raised by a spiral spring, surrounding the vertical bar, and is forced down by a lever, working like a pump handle, at the top of the arch, and connected with the bar by a toggle joint.

The claim is to "the general construction of the before described press; but particularly the wrought iron frame, which has the strength of a wrought iron bar drawn lengthwise; this principle is claimed however applied in the printing press, and of whatever shape the head and cheeks may be made, for seal or other presses."

22. For *Water Proof Umbrellas*; Edwin L. Simpson, Roxbury, Norfolk county, Massachusetts, November 19.

Silk, or other material, is to be coated with India rubber in the usual manner; the segments to form the covering are not to be sewn together, but cemented by means of dissolved caoutchouc. The ends of the junctures are to be attached to the ribs of the frame by sewing, but at other parts small pieces of India rubber cloth are to be cemented, across the ribs, to the cover.

23. For a *Portable Cooking Stove*; Thomas Whitson, and Gustavus E. Haynes, Roxbury, Norfolk county, Massachusetts, November.

This stove is, in preference, to be made of tin plate; it may vary in shape, but that represented in the drawing is oval. The oven occupies the middle part of the body of the stove, and has a door opening at the side in the usual way. There is a space between the bottom of the oven, and the bottom of the stove, and a similar space at top, these two being connected together by flues which pass up at either end of the stove. Dampers cover the tops of each of these flues, to regulate the draft. The fireplace, or furnace, with its ash pit, consists of a rectangular cast iron box, which slides in under the middle of the stove, at which part the bottom plate is removed; the furnace has the ordinary appendages. A pipe rises from the centre of the top plate, to carry off the smoke, and this plate is to be perforated for boilers.

The patentees say, "Although we have described the different parts of the said stove, yet we do not claim the different parts thereof separately as new; but what we claim as new, and of our invention and discovery, is the construction and arrangement of the whole of said stove, and its different parts in the connexion and combination, and for the purposes aforesaid."

There is about as much novelty in this, as in the larger number of the cooking stoves for which patents are obtained.

24. For an improvement in the *Washing Machine*; Alanson D. Lord, Bethany, Genesee county, New York, November 24.

This washing machine is said to be an improvement upon that obtained by G. A. Stocking, Sept. 10th, 1829, and which was noticed in vol. iv., page 403, as being very imperfectly described, and presenting no claim. We described it as consisting of "a wooden cylinder, the periphery of which is formed of rollers, turned by a crank, and having below the cylinder, a spring board furnished with rollers; when by turning the crank backwards and forwards, the clothes are made to traverse between the cylinder and spring board." The improved machine now patented bears the same general character; it is better described and represented than that upon which it purports to be an improvement, but still we are not informed in what the improvement consists, nor is there any thing in the form of a claim.

25. For a *Machine for Twisting Roving for Speeders*; Richard Fowler, and Richard Germond, Union Vale, Dutchess county, New York, November 24.

We cannot describe this machine at all, without allotting too much space to it, nor very well without drawings; some general idea, however, may be formed of its intention, though not of its construction, from the following quotation.

"The advantages of this machine will be obvious to all who have used the roving from the various condensing speeders, condensing by counter twist, or by rubbing; and the many attempts which have been made to impart the necessary strength to these rovings, show the importance of the results now obtained; and by using this simple improvement, the roving, in all respects better than that from the geared speeder, or fly frame, is obtained, and the great expense of those frames saved to the manufacturers. As many parts of this machine have been long known, such as the traverse and winding motions, and others—we, therefore, to the invention of these parts, separately, lay no claim whatever; but what we do specifically claim as our invention, is, all the parts and arrangement of the spindle above the bearing, consisting of the can, or cup, as arranged and fitted for turning the bobbin; and the principle and method of throwing off the roving from the bobbin by the action of the centrifugal power of its motion, and sustaining it against the inside of the can until drawn away by the receiving bobbin, and imparting to it, during this process, any quantity of twist, as before described. And we also claim the other parts of this machine as combined with the new parts invented by us, and the general arrangement of these parts as before described, by which we have produced a new and useful process or series of machinery, never before known or used."

26. For a *Weighing Instrument*, called the "Eagle Balance;" Levins Jencks, and Henry Dexter, Killingly, Windham county, Connecticut, November 24.

As this is called an eagle balance, we suppose that it is intended for weighing golden eagles, although, so far as accuracy is concerned, it would seem to be better adapted to the weighing of bald eagles, in which a grain more or less would not be a thing of very serious consequence. We have, in fact, never witnessed an equally ridiculous attempt at *improving* the common scales, than that now presented to us. Instead of a beam, there is to be a wheel, or pulley, which is to be suspended by a pivot, or pin, at its upper edge, by which it is to hang loosely; a strap, or chain, is to pass over the periphery of this wheel, and to one end of this strap the dish is to be suspended, and a counter weight hangs by the other. An index attached to the wheel reaches up to a graduated arch, its tilting causing the index to move. When more ponderous articles are to be weighed, a jointed index is employed, which has no fewer than four screws serving as fulcra, upon which turn the combined levers connected with it. The description, or specification, is in good keeping with the invention, being as imperfect and incongruous as it could well be made, and at the same time committing manslaughter upon orthography and mechanics.

27. For an improved *Scythe*; Horace Naramore, Caledonia, Livingston county, New York, November 24.

The improvement claimed is in the form of the scythe. "The length is to be four feet, the width in the widest part four inches; differing from the scythe already known, and in common use, in the following particulars. It is to be more circular in its form, the major part of the circle being at the head end of the scythe, instead of the point, reversing the usual method. Those made for cutting grain, when connected with the grain cradle, have the head reversed from the common method, which is a considerable convenience in fastening the scythe to the sneath of the cradle. The same form of scythe is recommended for cutting grass, with the following exceptions; the scythe should be made narrower and shorter; reference may be had to the common grass scythe as to these particulars. The heel also turns the same way as in the scythe already known. I would suggest that the scythe may be advantageously connected to the sneath by means of screws.

"What I claim as my invention, is the peculiar form of the scythe as above described, together with the method of connecting them to the sneath by means of screws. I do not confine my improvement to any particular size in length and breadth."

We have thus allowed the patentee to give his own testimony in his own way; a principal reason for our so doing, has been the seeming intangibility and indefiniteness of the thing patented, at least to us, possibly because we have never been a cutter of grain and grass; we refer the whole, therefore, to the judgment of the husbandman.

28. For an improvement in *Axles and Boxes of Carriages and Rail-road Cars*; Dexter C. Force, and Frederick Davis, city of Baltimore. First patented on the 6th instant; patent surrendered, and reissued on an amended specification, November 24.

A notice of this patent, as first issued, will be found on turning to p. 390; and it will be observed that no claim was made by the patentees; an omission which is now supplied. We extract the following from the present specification. "The box in the wheel we make of iron, or other metal, extending through the nave of the wheel, with one or more chambers in it, sufficient to contain the oil; and on the outer end, next to the axle nut, we leave a flanch of about three-eighths of an inch, or proportional to the size of the wheel, which is made to fit into a rebate formed in the axle next to the nut, by being turned down a little shorter than the nave, so as to permit the flanch of the box to fit in, and prevent the oil from escaping, and dirt from working into the box."

"What we claim as our invention, and not hitherto known or used in the above described axle and box, is the *thimble*, or *ferule*, and its application to axles of carriages, rail-road cars, and all kinds of mill gearing and machinery where the same can be used. And in the box we claim the *flanch*."

29. For a *Cooking Stove*; Levi Burnell, Elyria, Lorain county, Ohio, November 25.

The thing claimed in this stove, is "the horizontal rotary motion of the fire chest, in such a manner as to be able to apply, at pleasure, the greatest heat of the fire directly to either one of the boilers, griddles, or openings, in the superior top plate, while the said top remains stationary." We need not describe this stove, as that which was patented by Mr. E. D. Payne, on the 3th of March, 1834, of which the specification is given at p. 266 of the last volume, so completely *anticipates* it, as to render the task unnecessary; we refer to that modification of Mr. Payne's stove, in which he gives to it a circular form.

30. For a *Portable Horse Power*; Smith Gardner, Rochester, Munroe county, New York, November 25.

The driving wheel of this machine, which is fixed on a vertical shaft, is to be about three feet in diameter, and has cogs on the inside of its rim, the rim extending below the arms, for the purpose of containing them. These cogs take into a pinion on a vertical spur wheel shaft, which, by a train consisting of another pinion and spur wheel, with bevil gear, turns a horizontal shaft. The horse is to turn the first named wheel by means of a sweep; in the ordinary way.

The claim is to "the driving wheel as above described, that is,—having teeth, or cogs, on the inside of the circumference, instead of on the outside; also the combination and arrangement of the other

parts of the machine as above described, for producing a portable horse power."

Wheels with teeth on the inner side of the rim are well known, and are in many cases advantageously applied; not so, however, in the present instance, where it seems to have been adopted merely that it might be claimed. At p. 410 of the last volume, a horse power is described in which such a wheel is applied with much skill, and, we believe, with decided advantage, although we have not yet learnt the result of a trial in the large way. The claim in the present machine, to "the combination and arrangement of the other parts," is one which cannot stand, as there is not one single feature of novelty in it.

31. For *Moulds for Bending Scythe Sneaths*; Silas Lamson, Sterling, Worcester county, Massachusetts, November 25.

It is stated in the specification that the moulds usually employed are made of wood, which, from the heat to which the sneaths ought to be subjected in seasoning them, is apt to crack, or warp; the present patentee, therefore, substitutes moulds, either of wrought or of cast iron, and claims as his "improvement, the using of metallic, instead of wooden, moulds for shaping or moulding sneaths for scythes."

32. For an improved mode of *Fastening Scythes to Sneaths*; Silas Lamson, Sterling, Worcester county, Massachusetts, November 25.

A ferule is to be driven on to the end of the sneath, and fixed in its place by means of a key driven through a mortise in the ferule, and sneath; different modes of forming these ferules are pointed out in the specification, but in all cases the ferules, or "rings, are made fast to the sneath, and by the help of nuts, [and screws,] the scythe may be fastened with less trouble, and more permanently, than by the manner which has been common heretofore." Perhaps Mr. Naramore, (No. 27,) who has *suggested* that scythes may be fastened to sneaths by means of screws, may think his plan interfered with; screws, however, are common property, and the manner of using them in the two cases is essentially different.

[SUPPLEMENT.]

Notice of two Patents issued in July, 1832, which were accidentally omitted in their proper place, as were ten also in August, 1833.

For a *Rotary Steam Engine*; Luther Carman, Oxford, Oxford county, Maine, July 16th, 1832.

The claim made in the specification of this patent is in the following words. "I claim as my invention, the peculiar manner of making the valves aforesaid, and the particular manner of their operation. I also claim the block aforesaid, on the inside of the engine, which

holds the back pressure of the steam, and its peculiar manner of construction and operation afore described; to the other parts of the machine I lay no claim."

Those who are acquainted with the construction of the many rotary engines which have been patented, will perceive that there is at least a very strong likeness between some of them and the foregoing, and an examination of the whole description will show the similarity to be perfect. There is to be a circular cavity, into which two, or more, sliding valves are to pass, and which are to be retracted in passing a block, or stop, which fills the cavity, and between which and the valves the steam is to operate. The valves are forced in and out by means of an eccentric groove, in which work pins that are attached to them.

One head of the cylindrical drum is to be rendered steam tight by packing contained in grooves. The valves also, it is said, may be packed, if necessary; but how this is to be done, we are not informed; yet it is a thing of no mean importance, as none of the numerous attempts to make a firm and durable packing for such parts have hitherto succeeded. As it is now nearly three years since this patent was obtained, we are apprehensive that the patentee has long since learnt that his machine will not answer its intended purpose.

For a *Revolving Cylindrical Harrow and Seed-cart*; James D. Woodside, city of Washington, July 28th, 1832.

We need not describe this machine, as a full account of it may be found at p. 21, in a report of the Committee on Science and the Arts of the Franklin Institute.

List of Patents supplementary to that for August, 1833, containing such as were then accidentally omitted.

WITH REMARKS AND EXEMPLIFICATIONS, BY THE EDITOR.

1. For improvements in the mode of *Combing, Heckling, and Slivering, Hemp, Flax, Tow, and other Fibrous Materials*; Joseph Westerman, and James Westerman, Brooklyn, King's county, New York; aliens, who have declared their intention to become citizens of the United States; August 14.

This is a machine of too much complexity to admit of description, without the aid of engravings; the drawings accompanying the specification are extensive and minute, the whole apparatus employed in the operation being fully shown; the parts, however, that present the most novelty, and upon which the principal reliance is placed, are denominated the "slot wheel, angular moving comb, and heckler." The points which operate upon the hemp, or flax, in combing and heckling it, are made to advance and withdraw therefrom by motions which appear to be perfectly well adapted to the purpose of laying the fibres straight, and disengaging themselves without entanglement.

The whole specification would fill, at least, twenty pages of this Journal; we shall dismiss it, however, with the following extract.

"By the above combination of machinery, an angular eccentric motion is given to the comb bars, by the combination of the guides and slot-wheel-plates, as above described; whereby, when applied to the heckling and combing of hemp, and other materials, a gradual increase of velocity is given to the comb bars, from the time they pass the top centre of the circle of their motion, until they pass the point of the angle of the guides, the comb bars supporting the hemp, or acting upon the hemp, or other material, until it is taken in by the drawing rollers; after which the comb teeth are withdrawn, or disengaged from the hemp, or other material, by a direct backward motion on the line of their line of direction; and in these particulars our inventions constitute improvements over all other machines for the heckling or combing of hemp, or other materials, to which we contemplate their application.

"We claim, therefore, as our invention and improvement, the combination of slot-wheel-plates and angular guides, formed and combined as aforesaid, by which these motions are to be produced, and by means whereof the comb bars are carried to any desirable nearness to the drawing and receiving rollers. And we claim also as our invention and improvement, the application of the said motions to the purposes of combing, heckling, and slivering hemp, flax, silk, tow, and other fibrous materials of the like nature, by whatever combination of machinery they may be produced."

2. For an instrument for *Cutting, Paring, and Trimming, the Edges of the Soles and Heels of Boots and Shoes*; Ira Hatch, Essex, Chittenden county, Vermont, August 15.

A paring knife is fixed to a stock, furnished with a suitable handle, and a gauge, adjustable by screws, regulates the cut of it. The claim is to "the gauge, secured by a stock, to graduate the cut of the knife, to prevent it from coming in contact with the upper leather, and to leave the edge of the sole leather true and smooth, as required in cutting, paring, and trimming, the edges of the soles and heels of boots and shoes."

3. For a *Gun Lock*; Robert H. Faunt Le Roy, Posey county, Indiana, August 15.

The patentee says, "The principle of which I claim the discovery and invention is, that a gun-lock can be constructed containing such machinery, (to which I have applied the term *relief*,) as will supersede the use of double triggers, which machinery, or relief, is so combined with the lock as to be always ready when the lock or gun is cocked, and which is put into that state of readiness by the operation of the lock itself, thereby saving the time and trouble usually spent in springing, or setting, the double triggers now in common use."

For carrying this principle into operation, there are four different plans suggested, which are represented by four several drawings;

without these, the particular arrangements specified could not be understood.

4. For a *Worm Specific*; Charles McLane, Morgantown, Monongalia county, Virginia, August 19.

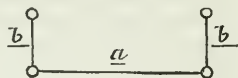
"Take of American cold pressed castor oil,	12 ounces.
Wormseed oil, ...	1½ ounce.
Croton oil, ...	22 drops.

Agitate these well in a bottle sufficiently large; then add of pure sweet oil four ounces; medicamentum, or oil of Haarlem, one bottle, (containing nearly half an ounce;) and the same quantity of oil of spike; then shake them thoroughly together, until the ingredients are incorporated.

"Give the patient (when from two to ten years old) a tea-spoonful of this medicine, in the same quantity of sweetened water, every morning on an empty stomach," &c.

5. For a *Machine for Cutting Straw*; Joshua Davis, Marysville, Charlotte Court House, Virginia, August 19.

In this machine there is to be a number of straight knives, placed at such distance from each other as shall be equal to the length of the straw to be cut. These knives are attached at each end, by means of joints, to a swinging arm, and the arms are also jointed at their upper ends to standards, making part of the frame work; the knives at their lowest point stand in the position shown at *a*, the swinging arms, *b b*, being at right angles to them. A lever, like a pump handle, is attached to one of the arms, *b b*, and serves to bring the knives down with a swinging motion; as they descend, the knives cut against bars placed on the bed of the machine, thus producing as many lengths of cut straw as there are knives, which straw falls through between the bars. The claim is to the general construction of the machine.



6. For an improvement in *Fences*; Samuel F. Dexter, Auburn, Cayuga county, New York, August 19.

The fence is to be made of wire, and directions are given for fixing posts, or standards, either of wood, or of hoop iron. There is no claim made, the whole subject being treated as though wire fences had never before been known; they are old, however, both at home and abroad; that is, the plan is old, but we do not know that there are any old fences upon this plan, as it has been generally abandoned.

7. For *Cisterns for Water*; Samuel Booth, Syracuse, Onondaga county, New York, August 20.

A round pit is to be dug somewhat larger than the intended cistern, and at the bottom of this a temporary floor of rough plank is to be placed, forming a circle which will not reach to the sides of the pit;

rough boards are then to be set upright, like the staves of a tub, their inner sides touching the temporary floor, and earth is to be rammed in between their outer sides, and the sides of the pit, until the space between them is firmly filled. The temporary floor is then to be removed, and the bottom of the pit covered with hydraulic cement; the surrounding boards are to be plastered with the same, and their upper ends also covered. The patentee says:

"What I claim as my invention, is the before described mode of forming hydraulic cement cisterns upon a frame of rough wooden staves set up in the pit, without head, hoop, or being jointed, depending upon the cement alone to hold the water, which it will do after the wood shall have decayed."

8. For a *Safety Guard for Gun Locks*; Heinrich Backmann, Lancaster, Lancaster county, Pennsylvania, August 21.

The guard described in the specification appears to deserve the name, as being well calculated to secure the piece to which it is attached against accidental discharge. It is so formed that the lock is never upon half cock; the description of it is clearly given, and although there is no formal claim, the nature and object of the invention are fully shown. The particular arrangement described, would require the drawing for its illustration.

9. For *Keys for Musical Instruments*; Edward Riley, city of New York, August 22.

The keys here meant are of the kind used on flutes, clarionets, &c. The first improvement claimed, consists in placing a small roller under each spring, attaching it to the instrument by means of a wire, thus diminishing the friction, and rendering the action more lively. The next improvement consists in "the position of the three lower keys of a keyed German flute; to wit, the juxtaposition at the upper extremity of the D key, the C natural, and C sharp keys, so as to bring the said extremities all under the same touch of the little finger, by placing the D key directly under the extremity of the other two keys." The third is the peculiar form of the lower C key, and the C sharp key, so that both may be brought down upon the holes simultaneously. All which are fully explained, and represented in the drawing.

30. For a *Machine for Cutting Grain, Grass, &c.*; William and Thomas Schnebly, Hagerstown, Washington county, Maryland, August 22.

The grain, or grass, is to be cut by blades working upon joints, like shears; these shears cut against projecting pieces, which stand out, like large comb teeth, from the advancing part of the machine; the principle is by no means new, although there is considerable peculiarity and novelty in some of the arrangements. The cutting blades are made to vibrate, as in similar machines, by motion communicated to them from the wheels. The claims are to "The reel

of open spaces and solid surfaces. The double edge shear. The roller setting on springs. The revolving plane, or sheet, or scraper. The projections or divisions of the grain."

One, at least, of the things claimed is old, namely, "The double edge shears;" the others may be new, but we cannot give a particular description of them in the space to which we must limit ourselves.

SPECIFICATIONS OF AMERICAN PATENTS.

Specification of a Patent for a Stove for Burning Anthracite. Granted to DENISON OLMSTED, New Haven, Connecticut, November 5th, 1834.

To all to whom these presents shall come, be it known, that I, Denison Olmsted, of the city of New Haven, and State of Connecticut, have invented a new and useful improvement in the construction of stoves for burning anthracite coal; for which improvement and invention I claim a patent, according to the laws of the United States.

And I, the said Denison Olmsted, do hereby declare the nature of my said improvement and invention, and the manner in which the same may be carried into effect, are fully made known in the following description and specification.

For *generating* the heat, I employ an anthracite coal stove, of ordinary construction, so far as relates to the chamber of combustion; but I prefer one made of sheet or cast iron, (I at present use sheet iron,) lined with fire brick, or lute. For *distributing* the heat, I use, instead of the open iron pipe generally employed for that purpose, a peculiar kind of apparatus, which I call a Radiator, constructed as follows.

A radiator consists of two concentric cylinders of iron, either sheet or cast iron, between which and around the inner cylinder, the heated current proceeding from the stove, circulates. Calling the outer cylinder A, and the inner cylinder B, their connexion, or arrangement, may be thus described: A, being a cylinder of any required dimensions, (as, for example, 24 by 9 inches,) and B a similar cylinder, but of smaller dimensions, (as, for example, 21 by 5 inches,) the two are placed upright; the top of B is brought to a level, or in the same plane, with the top of A, (although it is not essential that they should be in the same level at top, but this is the common construction,) being situated within it, and concentric with it, and reaching to within a few inches of the bottom of A. The inner cylinder, B, is closed at bottom, but open at top. The circular ring, or space, between the two cylinders at top, is closed, and a partition is inserted up and down on opposite sides of the inner cylinder, and the whole length of it, dividing the space between the two cylinders into two parts, so that the heated current, before mentioned, may descend on one side, and ascend on the other.

In order to distribute the heat from the inner cylinder, an air pipe is inserted in, or near, the bottom, which penetrates both cylinders,

and, being open at both ends, permits the internal air of the apartment to flow into B, as the air within B becomes rarefied by heat. Instead of the air of the apartment, fresh air from another apartment, or from out of doors, may be introduced through the air pipe, or the circulation of air through this pipe may be increased by elongating B upwards, by means of a pipe attached to it. A smoke pipe proceeds from the outer cylinder, A, near the top, which communicates either directly or indirectly with the chimney.

The radiator thus constructed being connected with the stove before described, by a short pipe, (the stove and the radiator usually stand side by side,) the heated current, when the stove is in action, passes through this pipe into the radiator, descends between the two cylinders, flows into the inner cylinder, B, ascends on the other side, and passes out at the smoke pipe, near the top of the radiator.

In order to remove such ashes as may be deposited from the heated current on the bottom of the outer cylinder, A, a small opening, closed by a door, or plate, is made in or near the bottom of A.

The stove above described is susceptible of various forms. The following are given as examples, viz.

1. We may employ a *single radiator*. In this case, we may either have smoke-pipes attached to both the stove and the radiator, each being furnished with a damper to regulate, or to exclude, the draft; or we may have but one smoke-pipe, namely, that communicating between the radiator and the chimney.

2. We may employ *two radiators*, one on each side of the stove. From each radiator, and from the stove, pipes enter the flue of the chimney, either directly or indirectly, each pipe being furnished with a damper. A convenient arrangement is to place the whole apparatus, namely, the stove and radiator, or radiators, parallel to the breast of the chimney, on the hearth, for example; and the fire-place being closed, to let the three pipes enter by apertures, left so as to form an opening into the flue of the chimney.

3. Where the communication with the flue of the chimney is made by means of a long smoke-pipe, the smoke-pipes from the radiators may be made to enter this pipe behind the damper, instead of entering directly into the flue of the chimney.

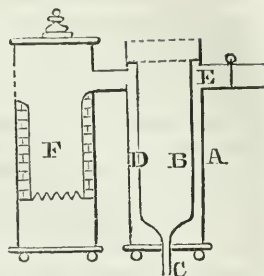
What I claim as new in the stove just described, is the use of a drum, or drums, of peculiar construction, so combined with the part of the stove which generates the heat, as to afford a new and very advantageous mode of distributing the heat.

I do not claim any thing new in the structure of the stove, that is to say, the part that generates the heat, otherwise called the chamber of combustion; nor do I claim the use of concentric cylinders, for distributing heat, as a new invention; but this peculiar structure of the drum, and its immediate connexion with the stove, as a substitute for the open pipe, or pipes, usually employed to distribute the heat generated in stoves for burning anthracite coal, I claim as a new and useful invention, being peculiarly economical, convenient, and efficacious.

DENISON OL MSTED.

Section of the Stove with one Radiator.

- A, the outer cylinder of the radiator.
 B, the inner cylinder.
 C, an opening by which air may enter the inner cylinder.
 D, space between the two cylinders, vertical partitions in which compel the draft to descend on the side next the stove, and to ascend on the opposite side, to pass off by the smoke-pipe, E.
 F, stove of the ordinary construction.



Specification of a Patent for a Machine for Hulling Clover, and other Seed. Granted to WILLIAM C. GRIMES, of York, in the county of York, in the State of Pennsylvania, November 8th, 1834.

To all to whom these presents shall come, be it known, that I, William C. Grimes, of York, in the county of York, and State of Pennsylvania, have invented a new and useful machine for hulling clover and other seed, and that the following is a full and exact description of the construction and operation of the said machine.

In a suitable frame, or husk, I affix a vertical spindle, or shaft, similar to the spindle of a mill stone; upon or near its upper end, I put a conic formed wheel, which I call the runner, it being in the form of a low, or obtuse cone, the upper surface rising at an angle of about twenty degrees from the horizon, (more or less.) Over this I place a hollow or inverted cone of wood, metal, or other material, the inner surface of which is to approach within an inch (more or less) of the surface of the runner. The whole surface of the latter is to be covered with punched sheet iron, or coarse emery, or made rough by other means. Attached to the inner surface of the cap, or inverted cone, are strips of metal, which commence at the rim, and run in obliquely towards the centre; these strips are to be fastened by their edges to the inner surface of the cap, or inverted cone, their width being nearly equal to the space or distance between the cap, or inverted cone, and the runner; leaving just space enough for the seed to pass through between their lower edges, and the roughened surface of the runner, without being bruised. The number of strips, or stops, as they may more properly be called, will depend upon the diameter of the inverted cone; the distance also from one to the other may be very much varied, but from three to four inches I think a suitable distance. The length of the said stops should be about two-fifths of the diameter of the runner, and their obliquity should be such as to cross at right angles, (or nearly so,) a tangent line, which should commence at the preceding stop.

In the centre of the top of the cap, is made an oblong or long oval

opening, like a small hopper, or funnel, which crosses the top of the runner, and extends about one-third of the way down its sides; the width of this opening is about one-third or one-half of its length. Into the said opening is fixed a kind of shallow hopper, the sides of which rise at an angle of about forty-five degrees from a vertical line, and are about three or four inches in width. The lower edge of the hopper is fitted down to the form of the runner, but does not come in contact with it, there being left all round a space of about one-eighth of an inch, for the admission of the unhulled seed.

The before mentioned spindle upon which is the said runner, has on or near its lower end a pulley, or strap wheel, which is to give motion to the machine. The lower end of the said spindle runs in a suitable box, or step, which is fixed upon a bridge-tree, similar to that of a flouring mill. Above, the spindle may run in a box, or bush, beneath the runner, or it may pass up through the runner, and be properly supported above; the latter, I think, is the best mode, as it will keep the runner more steady, and be much more easily kept tight in the box, and more convenient to oil, &c.

The following is a description of the principle of action of the before described machine. The unhulled seed should be let into the before mentioned shallow hopper in a continuous stream, the runner moving with great rapidity, say eight hundred revolutions per minute; its roughened surface draws the unhulled seed as fast as the same falls upon it, under the edge of the said hopper, while at the same time, if a nail, or stone, &c. falls into the hopper upon the runner, the latter throws it with such force against the inclined sides of the hopper, as to cause it to bound out, and to a distance from the hopper; hence such things as would otherwise be injurious to the machine, cannot enter it. Effectually to ensure this effect, the funnel-like opening may be lined with tin, or be otherwise made perfectly smooth.

The unhulled seed, after passing into the machine, or between the cones, passes under the edges of the said strips, or stops, when, by the impetus it receives from the runner, its projectile and centrifugal force causes it to leave the surface of the runner, and come in contact with the flat side of the next succeeding stop, by which its motion is arrested, and it falls down upon the rough surface of the runner, which in this way rasps or tears the hull from the seed.

The cap, or inverted cone, has a rim or flanch upon its lower edge, which surrounds the periphery of the runner, and upon which the former is supported. Suitable flooring is made just below the runner, and upon this flooring rests the rim of the cap, or inverted cone. A spout like that of a flouring mill, but of much larger capacity, is fixed at one side of the runner, opening into the space between the edge or periphery of the runner, and the rim or flanch of the cap, or inverted cone; which space may be about one inch, (more or less.)

The seed and hull, as they are discharged from the machine, may be conducted to, and be operated upon by, fans of the usual construction, to separate the hull, or chaff, from the seed.

The feeding may be effected in any convenient way, as by a re-

volving screen, or a feeding roller, running in a box or hopper above that of the machine.

What I claim as new, and as my invention, and for which I ask an exclusive privilege, is the before described machine for the hulling of clover, or other seed, upon the roughened surface of a rapidly revolving cone, having a cap, or cover, furnished with strips, or stops, operating upon the principle described, and thereby arresting the motion of the seed, whereby the conic runner with a high velocity effects the hulling of the seed, and, by the aid of the hopper, or funnel, at the apex of the cover, constructed in the way set forth, throws out any hard substance which would be sufficiently large to injure the machine.

I do not claim the covering of a revolving cone with perforated metallic plates, or the rendering the surface thereof rough in any other way; nor do I claim either of the parts of the before described machine taken individually, but only that arrangement and combination of their respective parts, by which a machine is constructed substantially like that herein set forth, so as to produce the same effect, upon the same principle.

WILLIAM C. GRIMES.

Specification of a Patent for a Machine for Hulling Clover Seed.
Granted to WILLIAM C. GRIMES, of York, in the county of York, and
State of Pennsylvania, November 3th, 1834.

To all to whom these presents shall come, be it known, that I, William C. Grimes, of York, in the county of York, and State of Pennsylvania, have invented a new and useful machine for hulling clover seed, and that the following is a full and exact description of the construction and operation of the said machine, as invented by me.

Upon a vertical spindle, or shaft, similar to that of a grinding mill, is fixed a wheel, or runner, the upper surface of which is made in the form of a low or obtuse cone, rising at an angle of about twenty degrees from the horizon, (more or less,) thus far being similar in form to the old-fashioned stone rubbers for hulling clover seed. Over the runner is placed an inverted cone, or cap, fitting on to the runner; the two surfaces, however, of the cap and runner, are not to approach nearer than about an inch, (more or less.) Into these contiguous surfaces or faces of the cap and runner, are driven concentric rows or circles of teeth, which last may be common cut spikes, or other suitable material. The space between these concentric circles or rows of teeth, may be an inch and a fourth, (more or less.) The teeth on the runner work between those in the cap; hence the said concentric rows of teeth on the runner and cap, when fixed for operation, are alternate, those of the runner standing up between those of the cap, and those of the latter projecting downwards, between those of the former; thus bringing the alternate rows to within about five-eighths of an inch from centre to centre, and leaving in the clear

about three-eighths of an inch, if the teeth are a fourth of an inch thick, which I think a suitable size. The teeth in the rows are usually placed about three-fourths of an inch the one from the other, but the distance may be very much varied, and the number of circles, or rows of teeth, in the cap, may correspond with those in the runner. The diameter of the runner may be very much varied, as from one to ten feet; but from three to five feet I think the most convenient.

Instead, or in place of, the concentric rows of spikes, or teeth, I intend sometimes to use hoops of rolled iron, fastened by their edges to the cone, and punched full of round holes, or the holes may be oblong, standing up and down; and also to cut or file teeth upon the edges of the said hoops.

The teeth occupy only about one-half of the diameter of the face of the wheel, or runner, but much more than half its surface, as the rows or circles of teeth commence at or near its periphery, and extend about half way to its centre; the remaining part of the face of the runner, that is, around the centre, extending to about one-half of its diameter, is covered with punched sheet iron, or made rough by other means, as with emery, or otherwise.

The runner and cap may be made of wood, metal, or other material; when made of wood, they may be built up of successive layers of plank or boards, the grain of each succeeding layer crossing that of the preceding: when made of metal, they may be cast to the proper form, with no greater thickness than what may be necessary to have the requisite strength. The teeth may be cast in the cone, or the latter may be drilled, and the teeth put in afterwards.

A vertical rim from the periphery of the concave cap, surrounds the runner, leaving a space of about an inch between the periphery of the runner and the inside of the rim. A spout similar to the spout from a flour mill, but of much larger calibre, or capacity, is let into the aforesaid space, for the purpose of discharging the seed and chaff from the machine, and conducting them to the fans; said fans may be of the ordinary construction, for the purpose of separating the chaff from the seed, but should be sufficiently large to suit the capacity of the machine.

Through the top or centre of the cap is made an oblong or long oval opening, crossing the centre of the runner, and extending each way as far, or nearly, as the roughened surface of the runner. The sides of this opening rise at an angle of about forty-five degrees from a vertical line, and may be lined with sheet iron, or other metal, which lining is to approach to within about one-eighth of an inch of the roughened surface of the runner, and rise about three or four inches above it. The object of having the sides of the opening in the cap inclined, and the lining approach near to the runner, is to prevent large and hard bodies, such as stones, &c., from passing into the machine to injure the teeth. When stones, nails, or sticks, &c., happen to fall in upon the roughened surface of the runner, the latter throws them against the inclined sides of the opening in the cap, with such force as to cause them to bound to some distance from the opening; even small straws are thrown out in this way; yet, notwithstanding

ing this, the chaff and seed are drawn in with great rapidity. The spindle of the runner may run in a box or step beneath, upon a bridge tree, like the spindle of a mill, and be supported above in a suitable box, or bush; or the spindle may pass up through the opening in the cap, and be supported in a suitable box above. The length of the said spindle ought to be at least as great as the diameter of the runner; and upon and near the lower end thereof, I put a pulley, or strap wheel, which is to give motion to the runner, which should have from five to twelve hundred revolutions per minute, according to its size, and other circumstances.

What I claim as new, and as my invention, in the before described machine for hulling clover, and for which I ask an exclusive privilege, is the concentric rows of teeth, placed in circles upon the cones, in the manner described; or instead thereof, hoops toothed and punched so as to operate between each other in a similar way, and produce a like effect. I also claim the general arrangement of that part of the machine by which the feeding is effected, and whereby stones, or other foreign substances, are thrown therefrom.

WILLIAM C. GRIMES.

Specification of a Patent for a Machine for thrashing and rubbing out Wheat. Granted to STACY WEST, of the county of Hartford, in the State of Maryland, November 11th, 1835.

To all whom it may concern, be it known, that I, Stacy West, of the county of Hartford, and State of Maryland, have invented a new and useful machine for the purpose of thrashing, or rubbing out, wheat, rye, and other small grain; and I do hereby declare that the following is a full and exact description thereof.

I construct a suitable frame, of strength sufficient to bear the stress which is to be put upon it. This may consist of four corner posts, into which are strongly framed the requisite side and end pieces. Upon this I mount four or more cylinders, by means of which the thrashing, or rubbing out, is to be effected. I in general use four cylinders only, and to this number I shall confine my description, although six, or more, may be used upon the same principle, but, I apprehend, without any adequate advantage.

For a machine of ordinary size, these cylinders may be each thirty inches long, and seven or eight inches in diameter. They may be made of cast iron, in one entire piece, but I usually make them of wood, and cover them with ribs of iron extending from end to end, so as to form the surface into flutes and ridges. The ridges may be about three-fourths of an inch apart, and the flutes by which they are separated about the same in depth. The edges of the ridges are to be notched, or serrated, forming teeth upon them their whole length.

The cylinders are placed horizontally, and turn upon gudgeons in suitable boxes, or bearings; a line uniting their gudgeons would form a quadrangle, there being two upper and two lower cylinders, forming two pairs, one lower and one upper being denominated a pair. I

call that the front of the machine where the straw is delivered, and that the back where the feeding is effected. The two front cylinders mash into each other, by means of their ridges and flutes, and would turn each other like the teeth of a wheel; but as they are not to touch, they are not allowed to do this, they being kept in their relative situations by means of the wheels on their gudgeons by which they are geared together. The two front rollers are placed at the distance of about half an inch from the two back ones; they run with very different velocities, and must not, therefore, interfere with each other. In a machine which I have constructed, these velocities are as six to one, which I think a good proportion; but this is a point which admits of considerable latitude.

I do not, in general, place the pairs of cylinders directly one over the other, but bring the lower back cylinder so far forward, that its centre is nearly under the space between the two upper ones, advancing the lower front cylinder in the same manner; the intention of this is to bring the lower back, and the upper front, cylinders nearly, but not quite, into contact with each other, as this materially aids in the operation of thrashing, much of the grain being rubbed out between these diagonal cylinders, before it passes between the two front ones, where it is completed.

The feeding is effected between the two back cylinders by means of a feeding table, or feeding apron, in the ordinary way.

The manner of gearing the cylinders, for the relative velocities above spoken of, is as follows. Upon one of the gudgeons of the upper back cylinder there is a cog wheel, of such size that it mashes into a pinion of one-sixth of its diameter, on the gudgeon of the lower front cylinder. At the other end each of the pairs of cylinders are geared together by wheels, or pinions, of equal size. Motion may be given to them by a whirl and band, or otherwise.

The bearings of the upper gudgeons are made capable of being raised by means of wedges, or screws, to regulate the distances of the pairs of cylinders to the kind of grain to be got out.

To admit of the receding of the cylinders from each other, in case of the introduction of any hard substance between them, I place on each side of the frame, and resting upon the boxes of the upper cylinders, an elastic bar, or strip, of wood, reaching the whole length of the frame, and confined at its two ends. These pieces may be about two and a half inches square, more or less, according to the nature of the wood employed.

To the front cylinders I usually give a velocity of from three to six hundred revolutions per minute; the effect, however, does not depend upon the velocity, as the grain is not beaten, but rubbed out, the back cylinders holding it, whilst this is effected by the more rapid motion of the front cylinders.

I do not claim any of the parts of this machine taken separately, the cylinders, wheels, and other parts, being such as have been before used for various purposes; but what I do claim is the employment of two or more pairs of cylinders, moving with different velocities, constructed in the manner, and applied to the purpose, hereinbefore set

forth. Not intending, however, to limit myself to the precise mode of construction and gearing which I have designated, but to vary the same in any manner in which a similar effect is produced by the application of the same general principle.

STACY WEST.

TRANSLATIONS FROM FOREIGN JOURNALS.

REPORT

To the Board of Directors of Bridges, Public Roads, and Mines, upon the Use of Heated Air in the Iron Works of Scotland and England. By M. DUFRENOY, Engineer of Mines. Paris, 1834.

[Translated for this Journal, by S. V. Merrick.]

Continued from p. 357.

REMARKS UPON THE NATURE OF THE COAL EMPLOYED IN THE FURNACES
USING CRUDE COAL.

It results from the preceding description, that certain coals, those of Wales, are employed in their natural state, for the fusion of iron ore in the smelting furnaces in which combustion is sustained by cold air.

That a great number of others—the coals of Glasgow, for example—are also susceptible of being used in the crude state, when the hot blast is employed; but that, for some varieties, the transformation into coke appears still to be indispensable, whatever be the plan on which the iron is made. To appreciate the causes which produce these remarkable differences in the properties of these coals, I have collected samples of most of those employed in the works spoken of in this report, which M. Berthier has analyzed in the laboratory of the School of Mines, and the results of which he has communicated.

Coal employed in the crude state in the Welsh Iron Works. Cold Blast.

	Dowlais.	Cyfartha.	Pen-y-danau.
Carbon,	0.795	0.784	0.768
Ashes,	0.030	0.028	0.032
Volatile matters,	0.175	0.188	0.200
	1.000	1.000	1.000

The coal of Dowlais is lamellar, separating across the layers in smooth and brilliant plates. This coal is composed of two distinct parts, one brilliant, dividing into small cubic fragments; the other, completely hard, fracture conchoidal, is nearly analogous to the Cannel coal.

These two varieties do not blend, but form in each strata small beds of greater or less thickness; the brilliant part greatly predomi-

nates. The Dowlais does not soil the fingers; it swells very little in coking, and does not cake; the ashes are perfectly white.

The coal of *Cyfartha* is rather slaty, or lamellar, but is composed, as the preceding, of the union of the brilliant and compact black parts, intimately mixed, like the quartz and feldspar crystals in granite.

These two varieties of coal act very differently; that having a brilliant fracture swells and cakes sufficiently, whilst the dull kind is dry, and does not change by exposure to the fire. It is probably this mixture that gives to the coal employed at the *Cyfartha* works, the property of resisting more than any other the action of the blast, and the different movements which take place in the furnace; its friability is also due to this circumstance; but the bitumen, which exists in sufficient abundance in the shining coal, cements the different parts of this coal, and gives it a great solidity after having been exposed to the fire.

The coal of *Pen-y-danau* has the same properties as the preceding, except that the mixture of the two kinds is less intimate. These three coals, belonging to the coal basin of Wales, are very dry, and owe this property to the excess of carbon which they contain; they are analogous to the coal of *Rolduc*.

Coals employed in a Crude State, in Furnaces worked with Heated Air.

	Environs of Glasgow.			Staff'd shire.	Derbyshire.	
	Clyde.	Calder	Monk-land.	Tipton near Wed'y	Butterly	Codnor Park.
Carbon,	0.644	0.510	0.562	0.675	0.570	0.515
Ashes,	0.046	0.040	0.014	0.025	0.030	0.030
Volatile matters, { Water, Gas, Tar,	0.005	0.039	0.115	0.300	0.400	0.455
	0.139	0.081	0.094			
	0.166	0.330	0.215			
	1.000	1.000	1.000	1.000	1.000	1.000

The coal of the environs of *Glasgow*, employed in the Clyde, the Calder, and the Monkland works, present characters sufficiently marked, and of a composition very analogous, as seen by the preceding table.

This coal is usually dull, a little compact, hard, and does not crumble between the fingers; it presents, in its transverse fracture, a series of small lines, which gives a slaty appearance, though it does not, in reality, possess this quality. It is very well stratified, and the lumps cleave in flat fragments, of greater or less thickness; the surfaces of separation are almost always marked by black carbonaceous

matter, which soils the fingers, and resembles charcoal in its fibrous appearance, and dull colour.

This coal is often traversed by extremely thin fillets of carbonate of lime, the direction of which is perpendicular to the layers, and sometimes pyrites is found.

The pieces of Glasgow coal submitted to analysis, softened but slightly; they cement together without change of form.

The coal of *Tipton*, which supplies the works of Lloyd & Forster, near Wednesbury, is slaty; it is composed of small beds, a few lines in thickness, separated almost always by an extremely thin bed of black carbonaceous matter, like charcoal. This substance is so abundant, that a piece of coal is rarely found at Tipton, more than four inches thick, which does not present one or two layers of this friable material. This coal, shining in its fracture, divides into small pseudo-regular fragments; it is slightly tenacious, and swells but little in coking.

The coals in the environs of *Derby* are divided into two principal qualities, designated under the names of *Cherry coal*, and *Soft coal*; the first, which is the harder, resists the action of the fire better than the second. The furnaces of Butterly, which use heated air, consume the Cherry coal exclusively; this coal is slaty, and presents lines of dull black, which gives it a strong resemblance to the coals of Scotland.

The soft coals, employed principally for steam engines, and puddling furnaces, are used also, at Codnor Park, for the roasting of ores. This coal is shining, slaty, and separates in pieces by very light pressure; it contains some thin portions of black and friable carbonaceous matter, already alluded to.

Notwithstanding the considerable loss which these two coals sustain by coking, they scarcely change their form; they swell and cake slightly, and their ashes are perfectly white.

Coals that appear to require transformation into Coke, when employed even in Furnaces worked with Heated Air.

	Birtly Works, near Newcastle.	Tyne Works, Northumberland.	Apdale Works, near Newcastle, Staffordshire.
Carbon,	0.605	0.675	0.624
Ashes,	0.040	0.025	0.035
Volatile matters,	0.355	0.300	0.341
	1.000	1.000	1.000

The coal consumed at the Birtly and the Tyne Iron Works, comes from the mines in the environs of Newcastle-upon-Tyne; it is shining, and splintery; it does not soil the fingers, nor does it crush by a light pressure.

This coal is, in general, very pure, containing no veins of carbonate of lime, or pyrites; it is very adhesive, and swells much by the action

of heat, so that the value of the coke exceeds that of the coal employed. I am assured at the Tyne works, that they have tried in vain to work Newcastle coal in the crude state.

The coal of the *Apdale Works* is lamellar, shining and splintering in the direction of the strata; it divides into small quadrangular fragments; in the cross fracture, it presents large bands, perfectly smooth, and very brilliant. This is owing to the super position of small layers, of which the nature is a little different; this coal is very adhesive, swells in the fire, and gives a light, silvery, but very solid, coke.

If we compare the composition of the different coals that we have examined, we perceive—

1st. That the coals employed in a crude state, in the furnaces worked with cold air, are dry, very carbonaceous, and, in fact, true anthracites.

2d. The coals, as those of Scotland and Derbyshire, which, though bituminous, serve, in a crude state, for the fusion of iron ore in the smelting furnaces worked with heated air, are, however, still dry coals.

3d. Finally, the fat, bituminous, adhesive coals, which change their volume, and swell by the action of fire, appear still to require a transformation into coke, to give advantageous results in the smelting of iron ore.

Quality of the Pig Iron and Bar Iron obtained in the Works using the Heated Air Blast.

The iron for castings made in Scotland, bears a less commercial value than that of Staffordshire. The first were quoted in the Liverpool market, in the month of July (1833) last, at 4*l.* 15*s.* sterling per ton, whilst the Staffordshire iron sold, at the same time, for 6*l.*

The difference between the price of these kinds, together with the prejudice generally entertained that the hot blast is unfit for the manufacture of iron, led some to doubt the advantages to be derived from the new method. The numerous observations I have made, tend, on the contrary, to prove that, for cast iron, at least, the products of the furnace working with heated air, are superior to those of the cold blast. The less value of the Scotch iron is no evidence against this opinion. In fact, the Staffordshire iron has always been regarded as the most suitable for castings, and has always borne a higher price than that from most of the other parts of Great Britain; perhaps, also, the great difference in price between the Scotch and Staffordshire irons, may be accounted for by commercial circumstances, for the Scotch now make iron much cheaper than others, and the production being increased almost one-third, by the employment of heated air alone, the iron masters have thought it to their interest to reduce the price of their iron, which they are enabled to do without loss.

It would be desirable if this important question could be decided by direct experiments; but for want of such, I will state the uses of these

different products in the arts—uses which are, perhaps, as conclusive as experiments.

In the works near Glasgow, they make iron only for the foundry; I have seen the iron which they produce employed for the manufacture of castings, which require great strength and softness, to wit: steam engine cylinders, boilers, gas pipes, mill gearing, &c.

At Birtly, near Newcastle, and at Butterly, near Derby, I have also seen steam engine cylinders, pipes for water pumps, and fastenings for iron bridges.

I should state that the furnace of Torteron, at the Fourchambault works, in the Nièvre, produces, since the use of this plan, gray iron, which competes in the market with that from England.

The iron manufactured from hot blast pigs, is also of very good quality.

At Codnor Park, near Derby, this iron is employed in the construction of different parts of the steam engine, of chains for suspension bridges, and of straps and cross-bars in iron bridges.

The iron produced at the Tyne works is wrought into sheets, for steam boilers, gasometers, &c.

At Wednesbury, the iron is also of good quality, and serves for purposes which require great strength.

These different examples prove that, by means of the hot blast plan, as well as by the old mode, superior metal can be made for foundry purposes, and which is well adapted for conversion into wrought iron; but it must not be thought that, by means of this plan, the faults which result from the nature of the ore, or coal, can be corrected.

Probable Causes of the Increase of Heat, due to the Use of Heated Air.

I have remarked several times, in the course of this report, that the temperature of the furnaces worked with heated air, appears to be higher than in those where combustion is sustained by the use of cold air; all the indications which are usually considered as guides for the working of the furnace, unite in proving this assertion.

The scoria does not attach itself above the tuyeres; the colour of the fire, in this part of the furnace, is so white as to be injurious to the eyes; the scorias, which are very liquid, flow with facility; the metal being hotter, can be cast directly into the most delicate objects. The quantity of ore in each charge is augmented in a great proportion, whilst the quantity of flux is decreased. This diminution in the proportion of melting is, of itself, the strongest proof of the increased temperature of the furnace; it indicates to us that the earthy matters find sufficient heat to fuse with a small addition of flux.

Probably it is to this excess of temperature that we should attribute the faculty of employing certain coals in a crude state, the transformation of which into coke appeared indispensable, at a less elevation of temperature.

In spite of these certain proofs of the increased temperature by the introduction of hot air into the furnaces, we cannot demonstrate its existence in a positive manner; but it appears to me that, to a certain point, a reason for this phenomenon may be given, by comparing that which passes in the furnace, by the constant introduction of air, to that which takes place by the mixture of two liquors of different temperatures, which we know will produce a mean temperature. The comparisons which I establish appear to me to be just, though the furnaces are in circumstances very different from the liquids having a given temperature, because the heat is reproduced without intermixture, by the combination of carbon and oxygen.

By admitting this cause of the augmentation of heat, it might be supposed to be very slight; on account of the great difference which exists between the temperature of the furnace, and that of the air which sustains the combustion; a difference that we have no accurate means of appreciating. I will show hereafter that this cause is not so feeble as might at first be supposed.

There is, I believe, another much more powerful cause, which it is impossible to estimate; it results from combinations, which could not be produced at the ordinary temperature of the furnace, and which are developed by the augmentation of heat due to the substitution of hot for cold air.

We see constantly, in our laboratories, examples of this phenomenon; substances which are acted upon slowly, and with much difficulty, by acids, at the temperature of the atmosphere, dissolve with facility when the liquor is slightly heated, and the combination formed often becomes itself a powerful source of heat. The operation of the smelting furnaces presents to us, perhaps, similar circumstances. The bitumen, and certain gases, which cannot burn at the temperature of the furnace using cold air, become ignited by the feeble augmentation of heat produced by the introduction of heated air; and the little smoke which passes out from the trunnel head when crude coal is consumed, and also the colour of the flame, authorizes the belief that the bitumen, the hydrogen gas, &c., are almost wholly consumed.

This supposition naturally answers the objection that may be made, that, even admitting a certain augmentation of temperature by the introduction of heated air, there can be no diminution in the quantity of fuel consumed, because the diminished amount of fuel used in the furnace is compensated for by that required to heat the air.

We have stated that the quantity of air injected into the furnace could, by its great mass, have the power of cooling it to a considerable degree.

This mass of air was raised in the Scotch works, before the adoption of the hot air plan, to 2800 cubic feet per minute, weighing 214 $\frac{1}{4}$ pounds. The quantity of air injected in each day, therefore, may be estimated at about 140 tons.

The total amount of coal, mineral, and flux, does not exceed thirty-four tons; the weight of air, therefore, injected into the furnace, is

more than four times that of the solid materials used in the same time.

We may conceive, therefore, that so considerable a mass, of which only a fifth part sustains combustion, thrown into the furnace at the mean temperature of the atmosphere, will produce a much greater refrigeration than when raised to the temperature of more than 600 degrees.

A circumstance which still tends to diminish, in a great degree, the refrigerating power of the air, by the use of the new plan, is, that the quantity of air is much less. In the furnaces of Scotland that we have taken for example, the quantity is reduced from 2800 cubic feet, to 2100 per minute, or twenty-five per cent.*

We can calculate the influence of the introduction of air upon the heat developed each instant, by the combustion of carbon; but it appears impossible to appreciate the augmentation which results from new combinations, caused by the combustion of the bitumen and carburetted gases, because we cannot, in the present state of the science, estimate the temperature in the interior of the furnace; the few observations that precede, though not giving any idea of the real influence of the heated air, appear to me, at least, to establish that it is very considerable.

Recapitulation.

The details into which I have entered upon the greater part of the works using heated air, have, perhaps, prevented the reader from seizing the principal circumstances of the plan; I deem it, therefore, useful to recapitulate briefly—

I. In all the works, with the exception of one or two, its introduction has resulted in an increase of the products, an economy in the consumption of fuel, and of flux, as well as in the expense of labour, and incidentals.

II. These advantages have followed in the same progressive ratio as the temperature to which the air has been heated.

III. The production of metal has generally increased.

* The specific heat of water being represented by 1.0000, that of the atmospheric air is 0.2669, from which it results that a gramme of air at 322° Cent., (612° Fah.) the temperature at which the air is injected into the Clyde furnace, would raise 0.733 gms. of water to 100°, (212° F.) supposing the air reduced to 10°, (60°;) and as the quantity of air introduced each minute is 124,779 gms., the heat which results from this mass is represented by 91,463 gms. of water, raised to 100°.

The charges at the Clyde works are now 34,416 kilogrammes of coal in twenty-four hours, or 23.90 kil. per minute, which, after deducting the waste by ashes, water, and gas, which escapes without being burnt, may be taken at a maximum of 20.30 kil.; the complete combustion of this quantity of coal would raise, in each minute, 1,465 kil. of water, from 0 to 100° centigrade; the increase of temperature which results from the temperature of the air at 322° cent., compared with that produced by the combustion of coal, would be as 92 to 1465, or one-sixteenth. This is the least ratio, the quantity of oxygen being insufficient to transform all the carbon into carbonic acid.

IV. The quantity of combustible matters burnt in the furnaces, appears to be nearly the same where the heated air is used, as before with cold air; the daily consumption at the Clyde being eighteen tons of coke, to obtain six tons of metal; now it is eighteen tons of coal, to produce nine tons of metal.

V. The metal produced in the furnaces worked with heated air, is generally gray, and fit for the foundry; nevertheless, this plan is employed with advantage in the works of which the pig iron is all, or in part, manufactured into bar iron, (Codnor Park, Tyne, Wednesbury, &c.) It is only necessary, for this purpose, to change the proportions of ore and fuel.

VI. In many works, the combustion requires much less heated, than it did cold, air; at the Clyde, for example, the same blast engine which served with difficulty for three furnaces, now blows four. The economy in motive force is not proportional to the diminished quantity of the blast, because a certain power is required to overcome the friction of the air in the heating apparatus, and the resistance which results from the expansion of the air by the heat. This last inconvenience is remedied by increasing the size of the tuyeres, their diameter having been increased from two and a half to three inches; the increased diameter of the tuyeres is also necessary to diminish the velocity of the current of air, when introduced into the furnace.

VII. When, as at Torteron, a diminution in the quantity of air does not result from increasing the temperature, additional power is required to move the blowing machine.

VIII. The substitution of heated for cold air, in the fusion of iron ore, is marked almost immediately by a change in the nature of the metal, which becomes more carbonized; the charges descend more slowly, but the working is accelerated by augmenting the proportion of ore.

Relative to the Apparatus.

IX. The apparatus formed by joining pipes of large diameter, which receive the air, and of small pipes, in which it is heated, and dilated, appears to me to be preferable to that composed of a series of pipes, of great diameter; requiring a smaller space, being less costly in the construction, and consuming less fuel than the last named; besides, the temperature is not uniform in all parts of this apparatus, and a current is usually formed in the centre, of diminished temperature.

X. To diminish, as much as possible, the velocity of the air submitted to the action of the heat, and to avoid the resistance due to its expansion, it is necessary that the surface of the small pipes should be more extended than that of the large pipe which receives the air from the blowing machine.

XI. The interior capacity of the small tubes ought to be greater than the volume of air injected into the furnace; by this disposition, the air remains a longer time exposed to the action of the heat, and acquires a more elevated temperature.

XII. From this last condition, the apparatus placed on the trunnel head appears to be of but little advantage to furnaces using coal; sufficient size cannot be given to it, to enable the air to remain long enough; to remedy this evil, the air is made to pass over another fire placed near the tuyere.

Relative to the Fuel.

XIII. The coals, very rich in coke, which are dry, and resemble anthracite, can be employed in a crude state, in furnaces working even with cold air.

XIV. The coals which contain a large proportion of volatile matters, (30 to 35 per 100,) but which are not very adhesive, and do not change form during combustion, serve, without being carbonized, to work in furnaces using air heated to 300° cent.

XV. It appears, finally, that fat and bituminous coals, like those of Newcastle, which are fit for the fusion of iron, must, even with the hot blast, be transformed into coke.

Extract from the Report of BENJAMIN WRIGHT, Esq., Civil Engineer, who was appointed by the Governor to survey the route of the New York and Erie Rail-road.

(Continued from page 364.)

In carrying the route of the rail-road through the heart of Sullivan county, and thereby giving great and permanent advantages to a large district of country, capable of sustaining a considerable population, I will make this passing remark, that by passing down the valley of the Neversink, from the foot of the Shawangunk mountain, until I reached the valley of the Delaware river, and then passing up the Delaware to the mouth of the Callicoon, I might have found a route of much easier grade, and which would not average over fifteen feet to the mile. But to that plan there are, in my mind, serious objections. 1st. It would be a more expensive line to grade, on account of its passing along steep side hills, and heavy ledges of rocks, requiring expensive rock excavation. 2d. It would not accommodate, or be very useful to, Sullivan county, as the country along the bank of the Delaware is not generally favourable to cultivation. 3d. It might come into collision with the Delaware and Hudson Canal, and perhaps divert some of its legitimate and fair business; and in its construction it might interfere with and injure that important and very useful work, for the execution of which, its enterprising proprietors deserve to be gratefully considered.

The line then passes up the Delaware, from the Callicoon to the village of Deposit, from which a lateral road may easily be extended into the heart of Delaware county. The route then crosses, by a bridge, the main or Mohawk branch of the Delaware, and thence follows up the Oquago creek to its source, on the route towards Betts-

burg, from whence it descends to the Susquehannah, and passing that river near Nineveh, follows up the valley of Belden brook to its source, and then taking the head waters of Page brook, follows that down the Chenango to Binghampton, or its vicinity.

An examination of the maps and profiles will show that several routes have been examined, between the Delaware river, at Deposit, and the Chenango, at Binghampton, and that lines were run on the most favourable ground, on a nearly direct course between Deposit and Windsor, on the Susquehannah, and between Windsor and Binghampton, from the Susquehannah to the Chenango.

Both these summits, however, proved to be considerably higher than those on the route chosen, and they cannot be overcome but by stationary steam power. For a more particular description, in detail, of the difficulties to be overcome, I refer to the report of Mr. Seymour; and I will only add, that, after having attentively examined these routes, I am decidedly of opinion that the northern route by Bettsburg, and by Nineveh and Page brook, ought to be adopted. That route, moreover, will possess a local advantage of peculiar value, in the facilities it will give to various branch rail-roads leading into the populous and wealthy sections of the state, along the valleys of the Upper Susquehannah, the Unadilla, and the Onondaga branch of the Chenango, and thus accommodating the counties of Otsego, Chenango, and Cortland, and part of the adjacent counties.

When the line came near the mouth of Page brook, on the Chenango, it became a question to determine which side of the Chenango we should pass down to near its mouth. A desire to approach near, and even pass into, the growing and important village of Binghampton, determined me to have the survey made on the east side; but ascertaining that the Chenango canal had not then been finally located, I directed a survey on the west side also, and to pass the river near the mouth of Page's brook. This part of the line I do not consider as settled, neither can it be finally determined until the canal is nearly completed; when that shall be done, we can see if there is a fair chance of carrying our rail-road on the upper side at a reasonable expense; and should this be the case, a preference ought to be given to the east side of the Chenango, so as to approach near to Binghampton, and pass over the river near the upper part of that village.

From the Chenango river, the route, in following down the Susquehanna valley for about forty miles, passes through the flourishing village of Owego, where it will become connected with the steamboat line now in preparation for navigating the Susquehannah, and also with the Owego and Ithaca Rail-road, which will connect the main line with the important and fertile section of the state adjacent to the Cayuga and Seneca lakes. After descending for forty miles along the east branch of the Susquehannah, we approach near the Pennsylvania line, north of Tioga river, (being a large branch of the Susquehannah,) and pass up its valley by Elmira, Big Flatts, and Painted Post, to the forks of the Conhocton and the Canisteo; and

then following up the Canisteo to its source, we pass Hornellsville, Almond, and over the summit between the waters falling into the Susquehannah, and the waters of the Genesee river.

Of nearly 130 miles on the route between the point where we leave the valley of Page brook, and near Almond, the grades are all extremely easy and favourable, or can be made so.

From near Almond, in going on westward, we pass the dividing ridge, where, for the present, we have made our grade line seventy-two feet per mile, but which can be somewhat relieved; and passing down Dike creek, we fall into the valley of the Genesee river, and run down that a few miles, and then up the valley of Van Campen's brook, through the villages of Friendship and Cuba, until we take the valley of Oil creek, then down that to its junction with Ischua creek, and down the valley of Olean creek to the Alleghany river.

Through this district, from the summit between the waters of the Susquehannah and Genesee, and the waters of the Genesee and Alleghany, we have some grades which reach fifty feet per mile, as the line is now run; but it is believed that considerable improvement will be made in this part, on a revision of the line.

Having reached the valley of the Alleghany, we pass down it about twenty-six miles, over excellent ground, generally, to the Indian village, near the Cold Spring creek. There, leaving the Alleghany, we pass up the valley of the Cold Spring, and over a small swell of land, and descend into the valley of the Little Conewango, a branch of the Large Conewango; and passing down that stream, and the Large Conewango, passing the village of Randolph, in Cattaraugus county, and the villages of Waterboro' and Kennedysville, in Chautauque county, following down the valley of the Great Conewango to the Casadaga branch, and up that to its junction with Chautauque outlet, we then follow up the Casadaga valley to Bear creek, and up that to near Bear lake; here we arrive at the dividing point between the waters which run southerly into the Alleghany, and those which run northerly into Lake Erie.

At this point, we are only about five miles in a direct line from Lake Erie, and 740 feet above it, and here is a place where we find ground favourable to descend by one plane 506 feet, in a distance of about one and a half miles; and at the foot of this plane we find ourselves nearly equidistant from Dunkirk and Portland.

At Dunkirk, the government of the United States have expended considerable money in the construction of a harbour, and are preparing to expend more. At Portland there has been no money expended, except by individuals. The government of the United States have had a regular survey and estimate of cost to make a harbour. I have obtained plans of each of these places, and return copies of them herewith. It is said that the cost of making a harbour upon the plan reported by Captain Maurice, of Portland, would be forty thousand dollars.

It will be seen by the maps and profiles returned, that a route was surveyed from Randolph, in the county of Cattaraugus, up the valley of the Great Conewango, to its source, and then striking off towards

Dunkirk. This route was tried in order to find a more direct and shorter course to Dunkirk, or to Fayette, at the mouth of Silver creek. This latter place has claims for its natural advantages for a harbour, and probably will receive attention at some future day.

In running the line to the head of the Conewango, and from thence beginning to descend the declivity toward Lake Erie, I was in hopes of finding ground favourable for descending at fifty or sixty feet per mile, and reaching Dunkirk by that grade, and thereby doing away the necessity of stationary steam power, and inclined planes; but I found the whole face of the country so cut by gulfs, and intersected by ridges, that I was defeated in my project, and abandoned it. The plan appears to me to deserve further exploration, before a final decision.

In selecting the Casadaga route, I have considered the advantages of its passing through the centre of the county of Chautauque, and approaching within about three and a half miles of Jamestown, at present the largest of all the towns in this valuable county. Its approximation, also, to the harbours of Portland and Dunkirk, tends to entitle it to a preference, while the strong probability that improvements will soon be made in the Alleghany river, so as to render it at all times navigable for steamboats, and the fact that it may now be navigated during a considerable period in the spring, render it desirable to continue the route as far as practicable down the valley of that stream, and thereby facilitate the direct communication between the city of New York and the great valley of the Ohio. And it ought also to be borne in mind that the construction of the road, as far as this point, will go far to insure its continuation through the western states to the Mississippi river, in which event that great western branch would leave the main line near the mouth of the Casadaga creek.

The total amount of linear extent from the Hudson river to Lake Erie, will be 483 miles, which distance may, however, be shortened from ten to fifteen miles by alterations in the route, which may be found desirable upon a further survey. The curves upon the roads are generally easy, none of them having less than 500 feet radius.

The graduation of the road has been estimated throughout for a double track, including embankments, in all cases, of solid earth, and embracing all necessary bridges, viaducts, and culverts, together with the expenses of grubbing and fencing, comprehending, in fact, the whole cost of the road, except that of superintending, of the damages (if any) to be paid for the land to be taken, and the expenses of the engineer department.

According to the report of Mr. Seymour, the expense of graduation, thus estimated, for the $222\frac{3}{4}$ miles between the Hudson river and Binghampton, will amount to \$1,551,982, being \$6,968.10 per mile; and according to the report and estimate of Mr. Ellet, the expense of graduation, thus estimated, for the remaining $260\frac{1}{4}$ miles, will be \$1,165,536, being \$4,478.51 per mile. Total graduation of the 483 miles, \$2,717,518, or \$5,626.33 per mile, including fencing, clearing in timber land 100 feet on each side, (to prevent trees falling

on the road,) and also all bridges over rivers, viaducts, culverts, road crossings, &c. &c.

Cost of grading as above,	\$2,717,518
Add 10 per cent. for contingencies,	271,751
	\$2,989,269

The cutting and embankments are all twenty-five feet wide, and the slopes of the embankments are one and a half base to one perpendicular. This I consider as a permanent and solid form, and calculated for stability.

The expense of superstructure will vary according to the particular plan which shall be adopted.

I have caused cross sections of several different roads now completed to be drawn, and have also drawn some which I think well adapted to the country through which the road will pass, for 400 miles, if a wood and iron road is adopted; these may be seen marked No. 5. That marked No. 2, is also of wood and iron, and is the common road as now built between Schenectady and Ballston, and such as will be built between Schenectady and Utica.

Such a road as No. 2, if built of yellow pine and oak, or chesnut, will cost, in Orange or Rockland, about 2830 dollars per mile.

Such as No. 5, will cost about 3400 dollars per mile.

Such as the Camden and Amboy, and the Columbia and Philadelphia road, cost 10 to 12,000 dollars per mile.

The Petersburg and Roanoke cost about 2600 dollars per mile, as I have been informed.

These are all for a single track, with one turn-out or sideling to each mile.

If the sum of \$3,400 per mile be taken, it amounts to

	\$1,642,200
	\$4,631,469
Add for engineering, &c., 3 per cent. on \$4,359,718,	130,791
Total,	\$4,672,260

This sum will grade and bridge over rivers the whole road for two tracks, and put down one track, which is all that ought to be done, until the road is travelled nearly its whole length; and this also includes the inclined plane, and steam power to operate upon it, and also a long and expensive wharf into the Hudson river.

These estimates are, in my opinion, liberal, and such as will make an excellent road, and, as I have before observed, there are many places where a great reduction might be made in the expense, by a small alteration of the grade.

The bridges over the large rivers I have also estimated higher than they will cost, if only built without regard to roofing, or otherwise protecting them from the weather. I have considered and planned these bridges to be only sixteen to eighteen feet wide, and so formed as to have a double track over them, but that so fixed as that loaded trains of cars cannot pass each other on those large bridges. I did

not think so much weight as two trains of loaded cars, passing different ways, ought to be permitted to pass on a bridge at the same time. It would perhaps bring fifty tons or more on it at the same moment, which is improper, unless in one long extended train.

I have also estimated one turn-out or sideling to each mile. If locomotive power is used on the long easy grades before mentioned, these turn-outs ought to be dispensed with, and only placed at every five to ten miles, as they are found extremely troublesome when locomotive power is used, owing to the carelessness and inattention in leaving them open, when they ought to be shut. I find that, on rail-roads now in use, the test of experience has shown it necessary to take up turn-outs which had been placed every mile, and only place them once in ten miles, and that at the water stations for the locomotive; and in this case, the man who attends the water stations sees to the turn-out being in its place, whenever the cars are coming in sight.

In making the estimate, I have put down the item of fencing, and also clearing away the timber on each side of the rail-road for 100 feet wide, to prevent trees from falling on the road. These items are of that kind, that, in many instances, there may be arrangements with the owners of property to save some part of the estimated cost.

In the reports of rail-roads which have been constructed and are now in use, the heavy items for pounded stone, which has been used for filling up trenches, have added very greatly to the expense. Experience has, however, satisfied most of the practical engineers, that the road does not stand as well, when laid on broken stone, as when laid on plank or timber, and the estimates have been made on the latter plan.

It is true, that almost every where along the line of this proposed road, there is small flat stone, or gravel, or sand; and, when the plank or scantling are laid in trenches, the small flat stone may be thrown in and rammed down, and they operate as drains to cast off the water from under these timbers into the side drains; and these being properly prepared to take away all water in them, the bed of the road is kept dry and solid.

Although the appearance of the road, as located, is circuitous, the curves have all more than 500 feet radius. As we have run the lines, and probably in making a final line of location, it will be found that the shortest or boldest curve need not be less than 600 feet radius. These are easier curves than some on the important roads now in use in the United States, and I do not consider that any difficulties will arise in locomotive engines turning them.

The report of the engineer on the Eastern Division, will show two routes from the town of Liberty, in the county of Sullivan, to Shohocking, at the junction of the Popacton, or the east branch of the Delaware, with the west branch, in Delaware county.

I have before observed that the route down the Callicoon was preferred, because it had less difficulty as to ascent, and the Beaver Kill route would have one inclined plane, near Young's Gap. This route by the Beaver Kill, is, however, nearly nine miles shorter than the

Callicoon route, and admitting that the tunnels (which are represented) are made, instead of going round the bend at Hawk and Sprague mountains, then the distance will be shortened three miles more, at least, making twelve miles shorter.

But still it appeared, on a comparison, that the saving in ascent and descent, amounting to something more than 300 feet, the easier grading on the Callicoon route, and the easier curves on the line by the Callicoon and Delaware, than on the Beaver Kill route, decided my mind in favour of the Callicoon route, although at increased distance.

The law under which this survey was made, provides that it shall commence at the city of New York, or its vicinity, or at such point as is most eligible and convenient.

The point on the Hudson river where the road would strike, it being still subject to further revision, and knowing that no great difficulties could arise in locating the road through the county of Westchester, the want of time and means prevented my effecting this survey. Considerations of policy would require this piece to be delayed until the other parts shall be in great forwardness, and then it will be made without doubt.

On an effectual method of cutting off the communication between the damp Foundation of a Wall built upon a moist subsoil, and the part of the wall above the ground; and on a mode of securing the inside of a wall from damp forced through the brickwork by driving rains. By JOHN ISAAC HAWKINS, Esq., Civil Engineer.

In consequence of reading the excellent paper of Mr. Kent, I am induced to send you an account of the method I took to cure one or two of the evils against which he warns his readers.

Soon after I had taken a lease (ten years since) of the cottage I now occupy, I discovered that the damp ascended the walls to the height of a yard above the ground, and that my furniture began to be injured by mildew. Finding that the foundation was laid upon a subsoil of clay, and knowing that a cure would be effected by interposing a water proof medium throughout the thickness of the wall, just above the level of the ground, I proceeded in the following manner: First, I made a hole through the wall, over the ground course, taking out two courses in height, and two bricks in length; consequently, the hole was six inches high, and eighteen inches wide. I filled up half this hole, at one end, with two courses of sound bricks, laid in Roman cement. It is clear that the operation could not injure the wall, the width of eighteen inches not allowing of any settlement. Two courses more, of nine inches in width, were next removed, making the hole again eighteen inches wide, the half of which was then filled up with bricks and cement, as before. The operation was repeated until the whole of the walls of the house were underpinned by two courses of hard bricks, and three joints of Roman

cement; constituting a water-proof septum, through which the damp cannot rise.

Local circumstances prevented easy access to two or three spots; and, my bricklayer not taking care that there should be three perfect joints of Roman cement in every part, the moisture still rises, in a few neglected places, in a small degree. But, with these few exceptions, the cottage, generally speaking, has been as free from damp, for nearly ten years, as if built upon a dry subsoil. The cost of 120 feet run of wall, for the most part fourteen inches thick, was about £15.

In recommending this plan, I would strongly enforce the necessity of performing the operation under every part of the house, partition walls, and chimneys. I yielded to the fears of my bricklayer, and suffered the stacks of chimneys to remain untouched; the hearths on the ground floors are, therefore, damp, except when a constant fire is kept up. There was, in reality, no danger of any sinking of the stack, as Roman cement, when of good quality, expands in setting, and affords as perfect a support as the bricks and mortar which were taken away, or, rather, a more perfect support than they had afforded.

In building a house on a moist subsoil, where the expense of a water-proof foundation might be an object, a couple of courses of brick, laid in Roman cement, immediately above the level of the ground, would prevent the damp rising above those courses. I have seen a single course of slate used for this purpose with good effect; and that is, perhaps, as impervious to water as three joints of Roman cement.

Mr. Kent's just observations on the absorbing qualities of place bricks are applicable, also, in a considerable degree, to the inferior stocks of which my cottage is built. The outer walls above the first floor are only nine inches thick, and the driving rains used to force the wet quite through them, and through the plasterings, throwing off the papering of the rooms. I cured this evil by scraping off all the plastering inside the rooms, and replacing it by a coat of Roman cement; since which time, no symptoms of damp have appeared on the inside of these walls. [*Loud. Arch. Mag.*]

¶ *Bread from Wood.*

Dr. Prout has clearly proved that all the chief alimentary matters employed by man may be reduced to three classes, viz. saccharine, oily, and albuminous substances, the most perfect specimens of which are respectively sugar, butter, and white of egg. The saccharine principle, in its extended sense, includes all those substances which are chiefly derived from the vegetable kingdom, means, in fact, the same thing as what we call vegetable diet. It comprehends all those substances, whatever their sensible properties may be, into the composition of which hydrogen and oxygen enter in the proportion in which they form water; for example, the fibre of wood, which chem-

ists call *lignin*. Much skilful manipulation and delicacy of experiment were required to establish this result; but the nutritive property of the woody fibre—in short, that a tolerably good quartern loaf can be made out of a deal board—has been proved by the recent labours of a German professor, and may be verified by any one who will take the trouble to repeat them. The following, says Dr. Prout, was the method he employed for this purpose: In the first place, every thing that was soluble in water was removed by maceration and boiling; the wood was then reduced to a minute state of division, not merely into fine fibres, but actual powder; and after being repeatedly subjected to the heat of an oven, was ground in the usual manner of corn. Wood thus prepared, according to the author, acquires the smell and taste of corn flour. It is, however, never quite white, but always of a yellowish colour. It also agrees with corn flour in this respect, that it does not ferment without the addition of leaven; and in this case sour leaven of corn flour is found to answer best. With this it makes a perfectly uniform and spongy bread; and when it is thoroughly baked, and has much crust, it has a much better taste than what, in times of scarcity, is prepared from bran and husks of corn. Wood flour, also, boiled in water, forms a thick, tough, trembling jelly, like that of wheat starch, and which is very nutritious. The nutritious properties were first tried on a young dog; afterwards he fed two pigs upon it; and then, taking courage from the success of the experiment, the professor attacked it himself. His family party, he said, ate it in the form of gruels, or soup, dumplings, and pancakes, all made with as little of any other ingredients as possible; and they found them palatable, and quite wholesome. [*Mech. Mag.*

¶ *Slabs of Slate fixed in a Bed of Concrete, as a Substitute for Granite Sleepers for Iron Rails.*

This plan is in contemplation for the London and Birmingham rail-road, and, with a view to prove the strength of slate so bedded, some experiments were made, July 2, on the premises of Messrs. Cottam and Hallen, in the presence of Mr. Solly, the chairman of the company, Mr. Stephenson, the company's surveyor, Mr. Palmer, the engineer, and other gentlemen; from which it resulted that slate, of a certain thickness, will answer all the purposes of granite, as a sleeper for the rail, at less than half the expense of that material. It was found, by the hydraulic press, that a cubic inch of slate will sustain a pressure of three tons and a half, and that, consequently, slate of an inch and a half thick is more than equal to any pressure which it can be required to support on the rail-road. Slabs of slate, of sufficient size and thickness, may be had for the purpose in abundance, from the quarries in Wales, Cornwall, and Ireland. It will require some ingenuity to fix them in the concrete, so as to prevent them from being shifted from their places by the vibrating motion of the wheels of the engines and wagons. In order to ascertain the best mode of effecting this object, it has been arranged that 300 or

400 yards of the Birmingham and London rail-road should be laid with slate sleepers, in the first instance. [*Morn. Chron.*]

Slate has lately been used as flooring for shops in London, and it has also been laid down in the Strand as foot pavement, in order to prove, by experiment, its durability relatively to that of Yorkshire flagstone. Its strength is such, that it might be used in all warehouses, instead of boards for the floors; and thus, by means of cast iron joists, such buildings might be most effectually rendered fire-proof. In common dwelling houses, fireproof partitions, and fireproof chests and closets, might be formed of the same material, joined by iron or copper. [*Loudon's Arch. Mag.*]

Compositions of Concrete for Foundations.

1. A writer in Loudon's Architectural Magazine states that he has used concrete in the proportion of five of loamy gravel to one of stone lime. Dry brick rubbish may be used with the gravel, or, in fact, any other material, if carefully spread, and used sparingly. These proportions will be found to answer well. This kind of foundation is not very new, for Carter informs us that the foundations of Westminster Abbey, erected 1245, consist of flints, irregular stones, rubble, and mortar, forming together one almost impenetrable body. In many of the ancient remains of castles, particularly in Kent, the foundations are made in this manner. [*L.*]

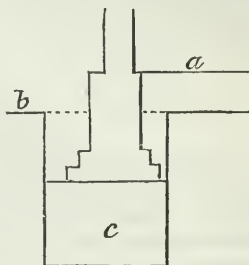
2. A second method of forming this composition, given in the same journal, is the following.

Take Thames washed shingle, and Dorking lime fresh from the kiln, and finely powdered, in the proportion of six bushels of shingle to one bushel of lime, with a due quantity of water. These are to be intimately and properly mixed in small quantities, (say a small barrowful,) and then thrown from a stage at least five feet high, while hot, in equal layers; every layer to be well rammed. [*Reader.*]

3. Mr. Thorold states that concrete foundations are usually made with Dorking lime; but he apprehends any water lime will do as well. He adds,—We use, for water-works, lime burnt at Heyden, in this county. There is also a capital lime made at Reach, and at Burwell, in Cambridgeshire, which is used in water-works all over the Fen country; both these limes are sold at the kilns for about 6d. per imperial bushel. This is very important, for, with Dorking lime, concrete foundations cost nearly as much as brickwork, all things considered. With regard to the proportions of materials, I should advise experiments to be made with local materials, to determine them. Pieces might be formed of not less than a foot cube, or, what is better, an old tea chest might be filled with them. The lime should be fresh from the kiln. I believe concrete was first suggested by Semple, in his *Treatise on Building in Water*; Dublin, 1777.

4. Whenever I have used concrete in the foundation of buildings, says Mr. Watson, I have had a wide square trench dug out, about

eight inches wider than the lowest course of brickwork, and to such a depth as to insure a tolerably firm foundation. The annexed figure will show this more distinctly. In this figure, *a* is the floor line; *b*, the ground line; and *c*, the concrete. When the trench is made, I have coarse and fine gravel thrown into it together, (just as they come from the pit,) to a thickness of about four inches; I then have it grouted with thin hot lime, only just enough to bind the gravel together. The mixture must now be rammed down hard. Course after course must then be laid, and so treated, till the mass reaches to within about eighteen inches of the ground line. The proportion of hot lime to the gravel is about one-eighth part only, which I think is enough. It was Walter's Sutton flare-burnt lime which I used. I think this plan better than first mixing the gravel and lime, but this may be a mere matter of opinion. The mixture hardens in a few days, in the most complete manner. After the brickwork is built on it, immediately fill the sides of the trench with earth, ramming it in well, to prevent the rain from affecting the concrete. [Ib.]



¶ Origin of Mouldiness.

“Water, which holds organic substances in solution, very frequently develops living beings, viz: the *infusares*, which belong sometimes to the animal, and sometimes to the vegetable, kingdoms. These substances, which have been regarded by certain naturalists as the product of spontaneous generation, ought to be considered with greater propriety as owing their appearance to the development of certain invisible germs, which are scattered throughout nature with profusion, and which only require favouring conditions to assume their being, and to develop themselves.” “I have completely satisfied myself that mouldiness is the growth in air of aquatic filamentous vegetables. I have seen, in the most distinct way, the aerial filaments of the mould springing from the stalks of the aquatic filamentous vegetables, sometimes by a production from the side, and sometimes by the sprouting out of the extremity of one of these aquatic filaments, which, in coming into the air, become, by that alone, a filament of mould.” “I dissolved a drop of the most liquid portion of the albumen of a new laid egg in an ounce of water, and put it into a flask. This liquid was preserved for a whole year, exposed to the light and put into the dark, but it never exhibited the least trace of mould. It did not even develop a single atom of greenish matter.” “A drop of acid in an ounce of water, produced mould in eight days. Mercury, whether in the state of salt, or of an oxide, completely obstructs the appearance of mould.”—*M. Dutrochet, in the Edin. Phil. Jour.*

If the albumen of the egg so completely prevents mouldiness in water, might not this fact be taken advantage of in preserving in a sweet state the water on board ships? Albumen is not only harmless, but nutritive, and eggs are very cheap.—W.

[*Lond. Mech. Mag.*

¶ *New Material for Cables.*

A series of trials have lately been made at Paris, to ascertain the comparative strength of cables made of hemp, and of the aloe from Algiers. These trials all turned to the advantage of the aloe. Of cables of equal size, that made of aloe raised a weight of 2000 kilogrammes, that made of hemp a weight of only 400 kilogrammes.

[*Ibid.*

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Calculated by S. C. Walker.

Day.	H'r.	Min.					
4	7	49	Im.	y Virginis,	,6,7,	N. 109°	V. 118°
4	8	36	Em.			185°	205°
5	9	21	Im.	r' Libræ,	,6,	112°	129°
5	10	12	Em.			194°	229°
11	12	39	Im.	35 Capricorni,	,6,	76°	58°
11	13	47	Em.			328°	325°
14	14	10	Im.	Piscium,	,4,5,	111°	139°
14	15	30	Em.			325°	211°

Meteorological Observations for March, 1835.

Moon.	Days.	Therm.		Barometer.		Wind.		Water fallen in rain.	State of the weather, and Remarks.
		Sum. rise.	2 P.M.	Sum. rise.	2 P.M.	Direction.	Force.		
	1	3 ³⁰	19 ⁰⁰	30.50	30.24	W.	Moderate.		Clear day.
	2	7	21	.30	.30	SW.	do.		Clear day.
	3	13	19	.30	.34	W.	do.		Clear day.
	4	5	22	.45	.50	W.	do.		Clear day.
	5	14	30	.47	.47	E.	do.		Clear day.
	6	16	37	.30	.25	SE.	do.		Clear day.
	7	30	32	29.35	29.75	N.E.	do.		Clear day.
	8	32	42	.80	.93	N.E.	do.		Clear day.
	9	32	43	30.00	.93	SE.	do.		Clear day.
	10	31	32	29.73	.60	E.	Calm		Clear day.
	11	32	43	.86	.95	W.	do.		Clear day.
	12	29	47	30.14	30.14	W.	do.		Clear day.
	13	37	55	29.65	29.65	W.	Moderate.		Clear day.
	14	32	52	.90	.90	W.	do.		Clear day.
	15	37	57	.65	.47	Variable.	do.		Clear day.
	16	43	57	.57	.54	S. SW.	do.		Clear day.
	17	47	47	.46	.70	W.	Variable.		Clear day.
	18	23	41	30.10	30.14	N.E.	do.		Clear day.
	19	32	42	29.45	29.45	W.	do.		Clear day.
	20	32	54	30.00	30.00	SW.	do.		Clear day.
	21	42	64	29.75	29.70	SW.	do.		Clear day.
	22	37	35	.40	.20	E. N.	do.		Clear day.
	23	25	31	.45	.70	W.	do.		Clear day.
	24	29	44	.70	30.50	SW. SE.	do.		Clear day.
	25	32	50	30.25	.35	SW. SE.	do.		Clear day.
	26	41	63	.30	.16	SW. W.	do.		Clear day.
	27	50	63	29.95	29.95	W.	do.		Clear day.
	28	47	62	.75	.65	W.	do.		Clear day.
	29	39	51	.60	.60	Variable.	do.		Clear day.
	30	39	43	.60	.60	Variable.	do.		Clear day.
	31	36	55	.60	.56	Variable.	do.		Clear day.
	Mean	30.55	43.61	29.87	29.90			3.55	

Thermometer.

Maximum height during the month, 64. on 21st,
Minimum do. 3. on 1st.
Mean do. 37.08

Barometer.

30.50 on 4th.
29.20 on 22d.
29.89

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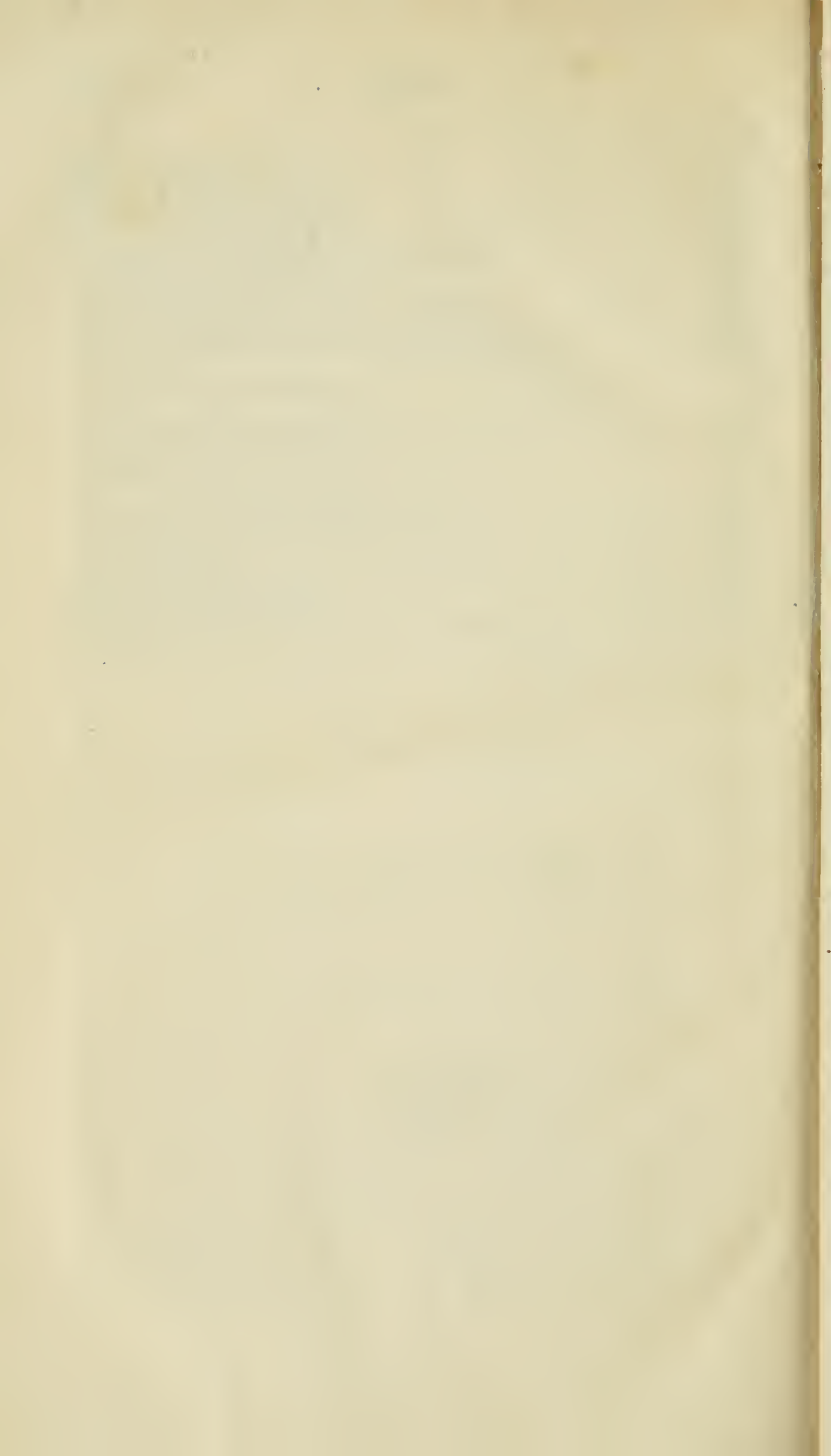
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